Rural Economic Growth: Overcoming the Hurdles

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BROWN

Figure: Akkunji wins gold

Introduction I

- While rural economy is a decreasing share of economy it is critical to sustained growth)
- Source of new consumers and workers
- Consumption is part being sustained through transfers (PDS, MGNREGS, remittances, procurement)
- But transfers are in part simply shifting consumption
- Need to actually increase worker productivity

Introduction II

- How will this happen?
  - Increase overall productivity
  - Mechanization
  - Growth in non-farm sector
  - Migration
- What are the key hurdles here?
  - Land markets
  - Labor markets
  - Credit markets
  - Commodity markets

This Talk I

- There are substantial unrealized positive scale economies in Indian rural agricultural.
- These arise in part due to the complementarity between machinery and land size, and also due to credit availability.
- High labor utilization in small farms provides comparable yields but cost is high
- Thus consolidation/amalgamation of farms would potentially release substantial labor, with increased returns to land and without increasing the wage

This Talk II

- But labor release requires substantial growth in the non-farm sector both in urban and rural areas
- Non-farm activity is important but generally small in scale
- Specialization in agricultural production may not be associated with comparative advantage and thus may not support value-added activities
- Increases in specialization and in value-added activities in rural areas likely critical to long-term absorption of workers in rural areas

Landsize

- Are small Indian farms efficient:
  - Large empirical literature using data from 1970s/1980s
  - Higher labor use and negative yield area relationship
  - But this ignores costs of inputs
- When costs are priced out at market wages generally see higher profitability for larger farms. (Carter, 1984; Lamb, 2003)
  - But it is not clear that either approach is right.
  - Clearly given activity of labor market the shadow value of family work is not zero
  - But if shadow value is the wage then it is unclear why labor-land ratio is higher on small farms.
- One hypothesistied to differences in supervisory cost. Feder (1985); Eswaran and Kotwal (1986)

Landsize

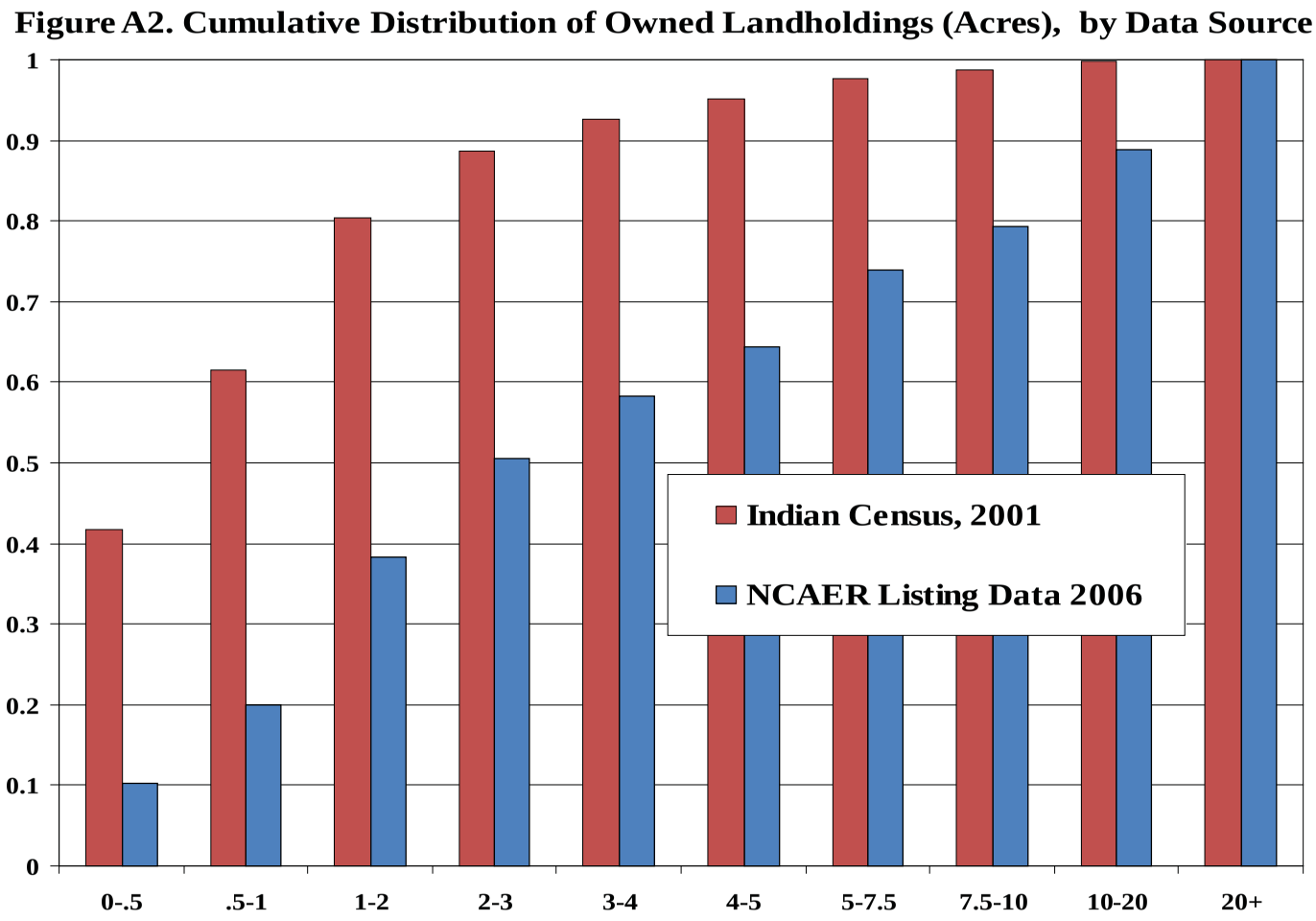
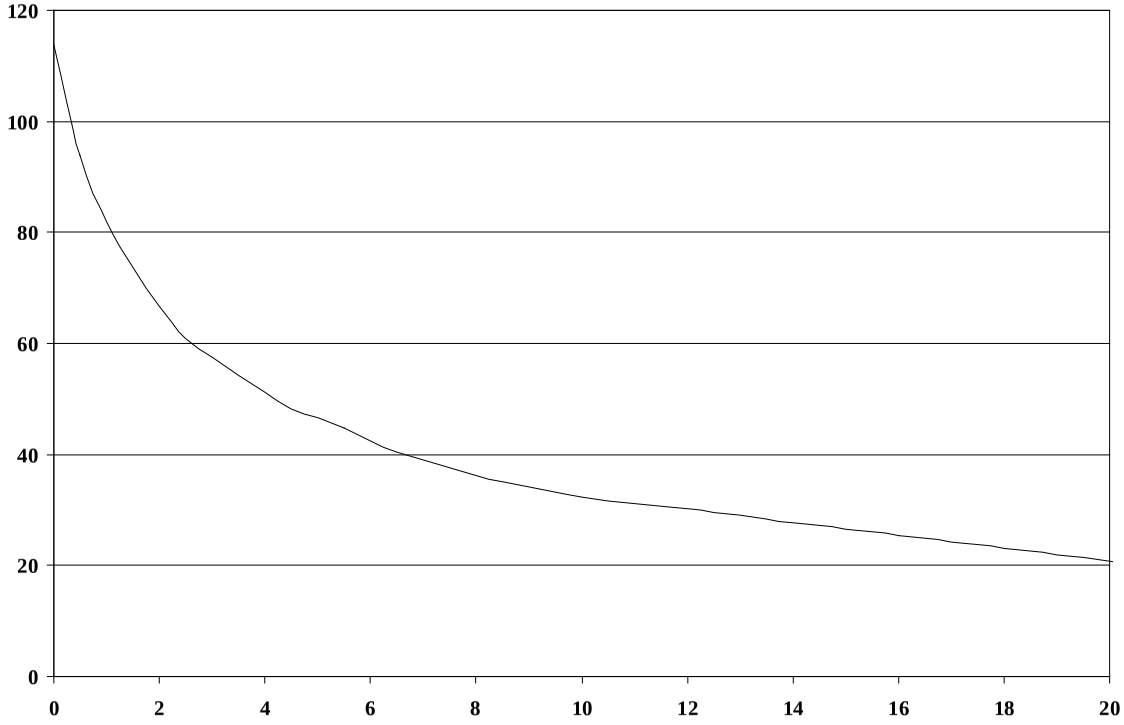


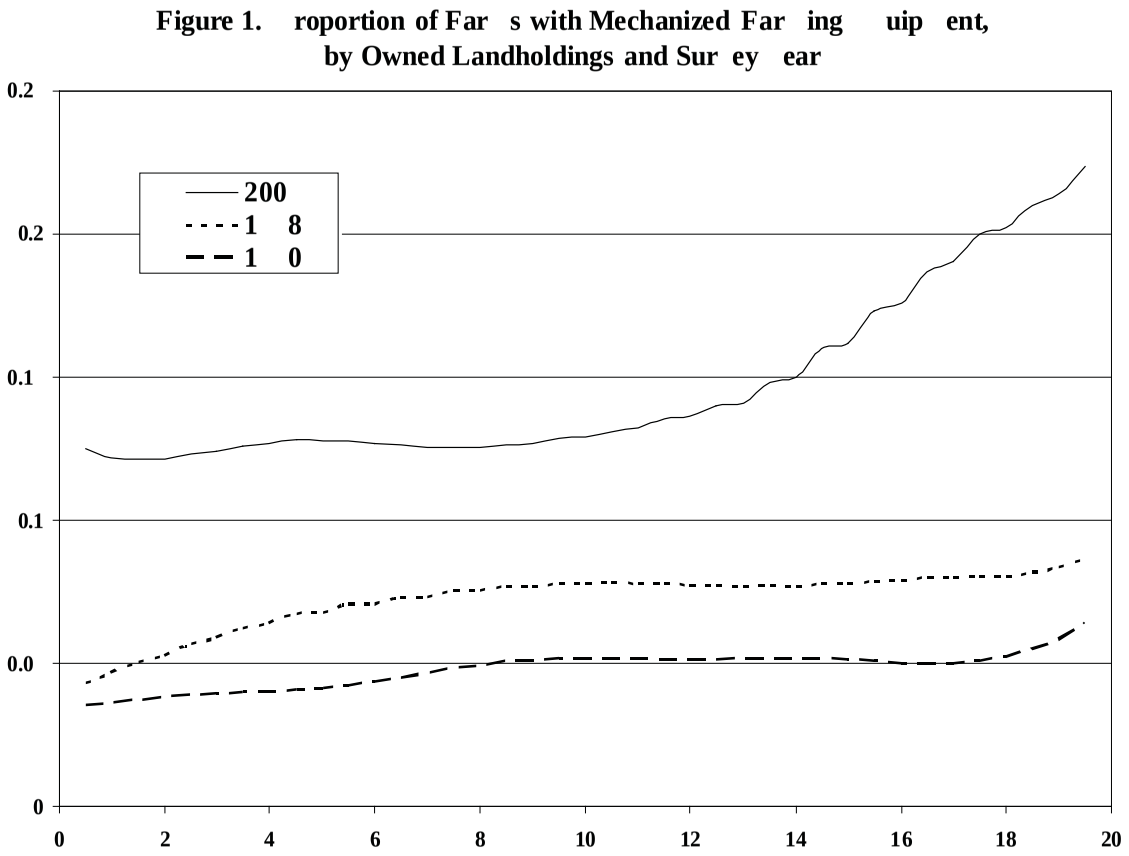
Figure A2. Cumulative Distribution of Owned Landholdings (Acres), by Data Source
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0-.5
.5-1
1-2
2-3
3-4
4-5
5-7.5
7.5-10
10-20
20+
Indian Census, 2001
NCAER Listing Data 2006

Labor per acre by acreage

Figure A3. Total Mandays of Labor Used per Acre, Adjusted for Gender and Age, by Owned Landholding Size



Emergence of machinery by farm size

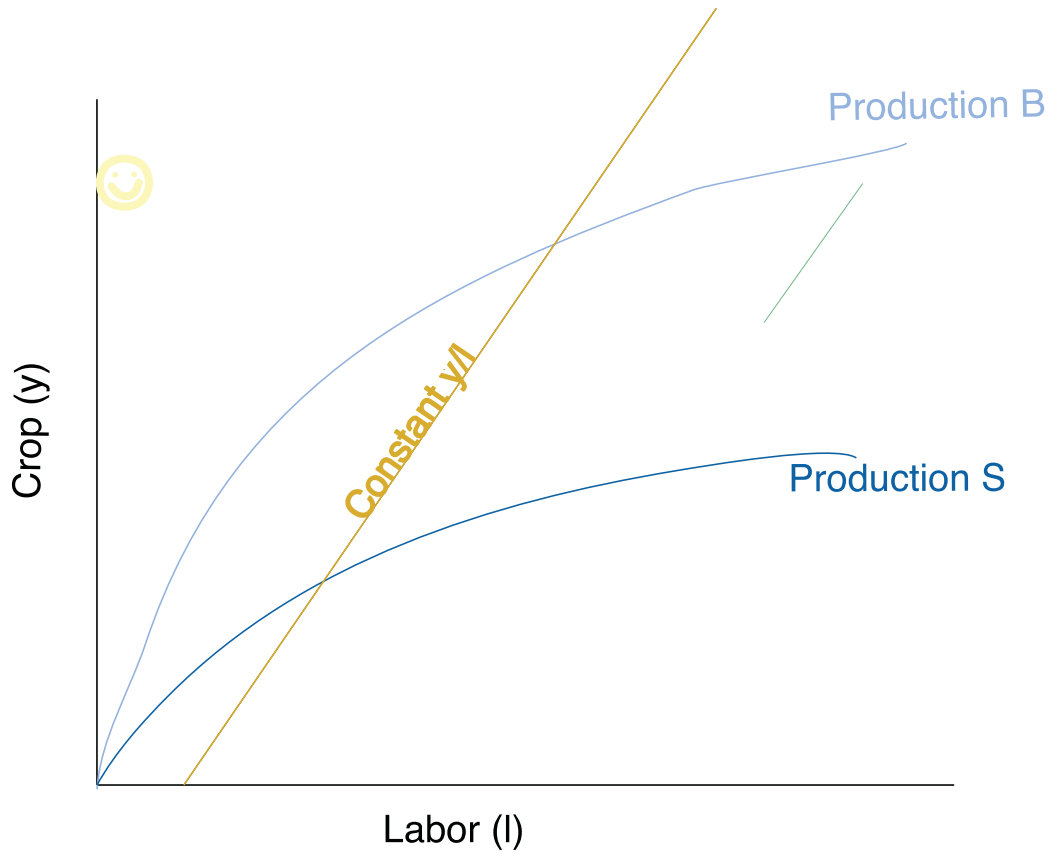


Rice Harvesters of Different Capacity

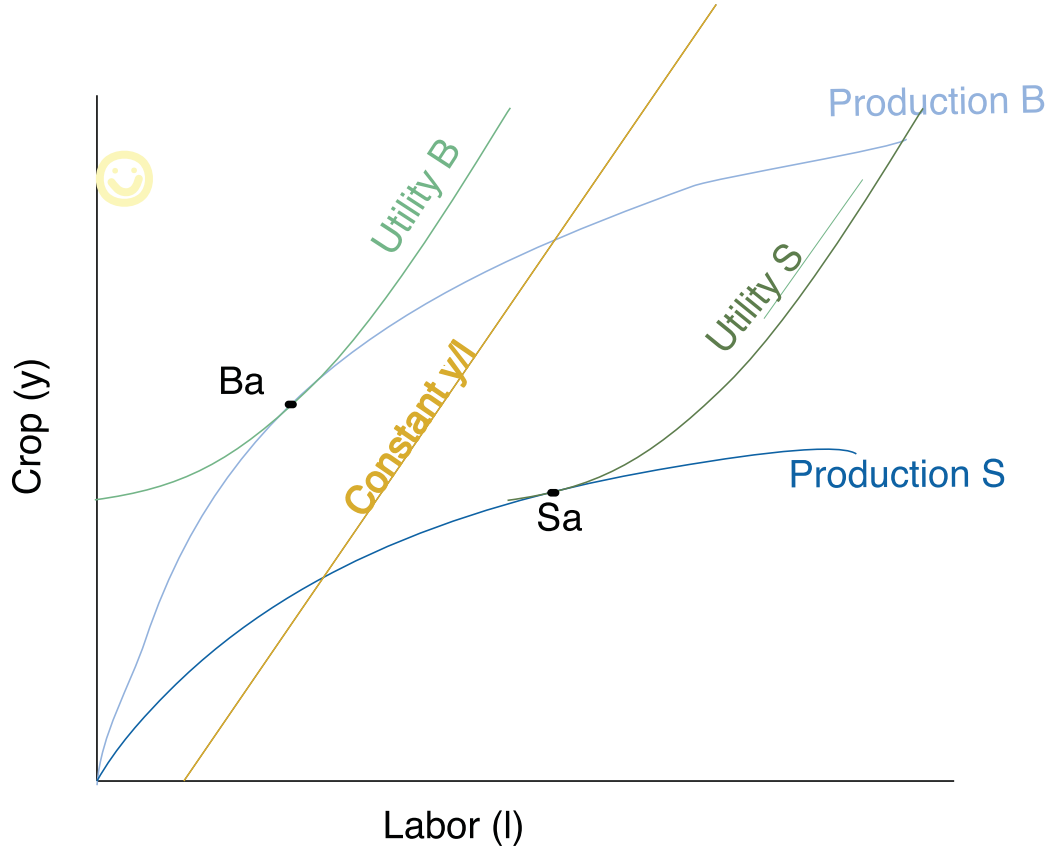
Model

- Delivers a formula for costing out family laborand
- Shows that cost of labor varies by regime and thus must be computed by stage of production.
- Links scale economies to mechanization through machine capacity and the scale-specific cost of combined machine/human effective effort
- Scale economies are tied to contiguous land
- Links scale and mechanization to credit market imperfections
- Provides a framework for constructing a rental reservation price

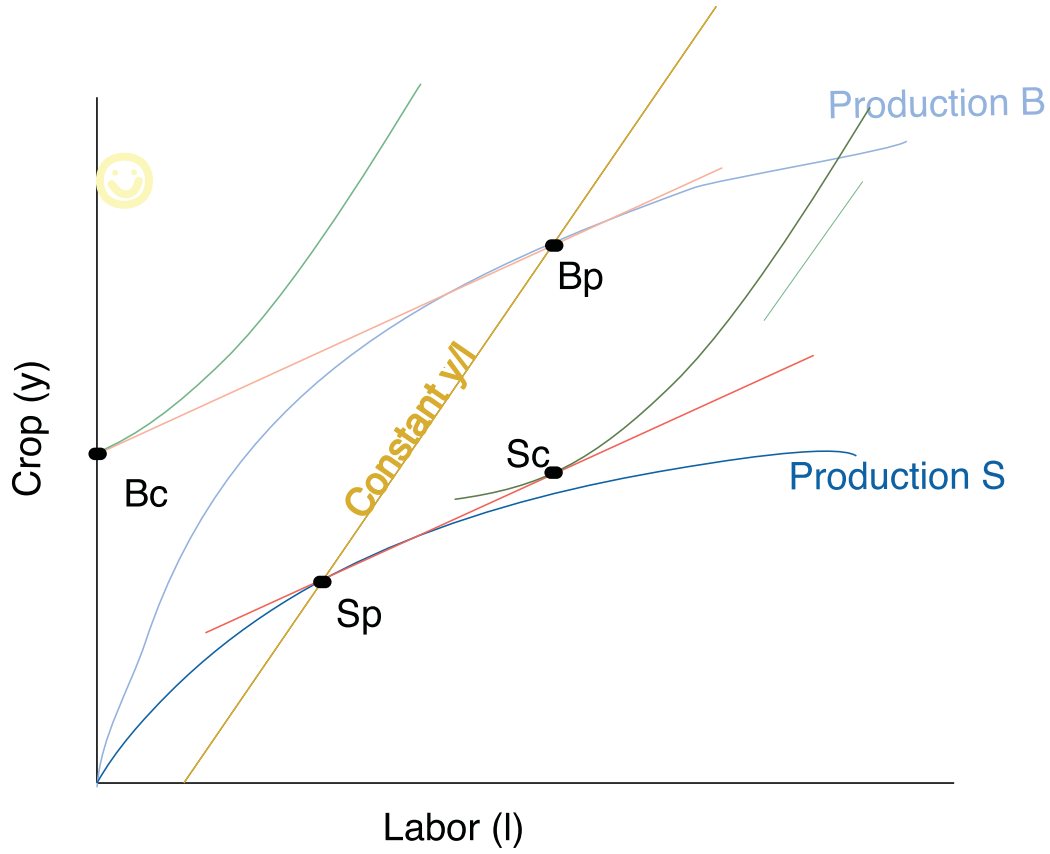
Output and labor use for small and big farms



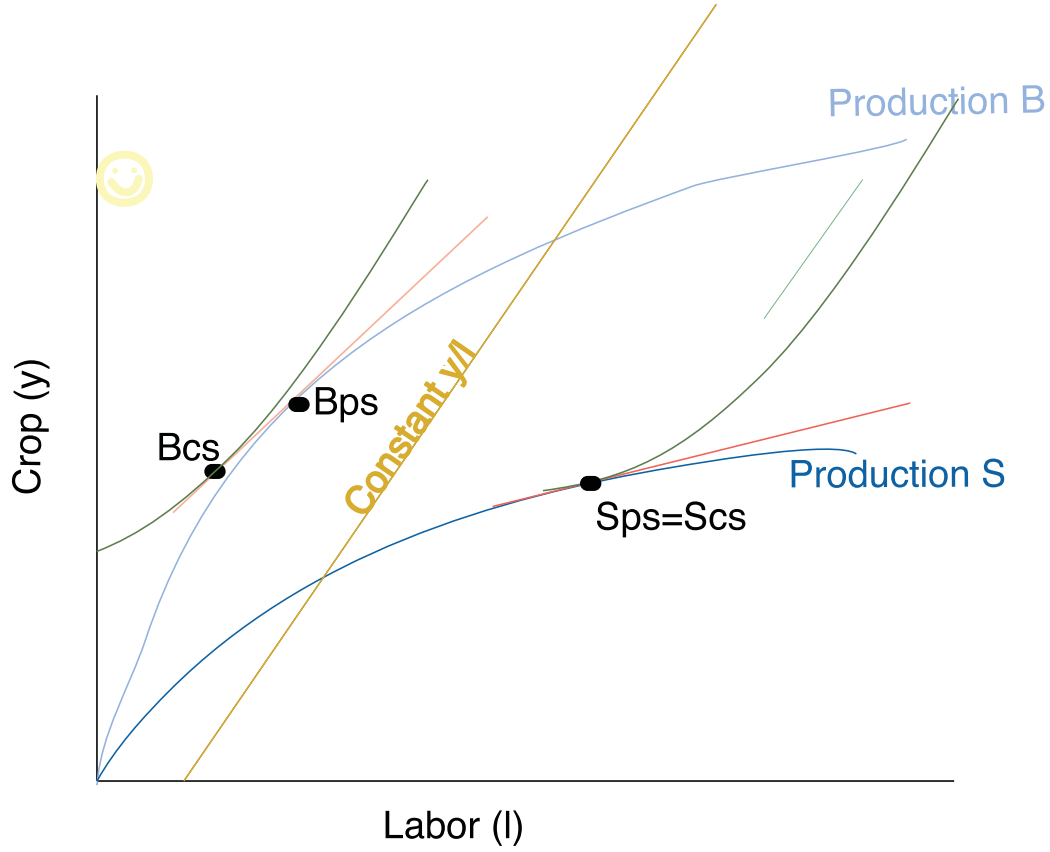
Output and labor use for small and big farms



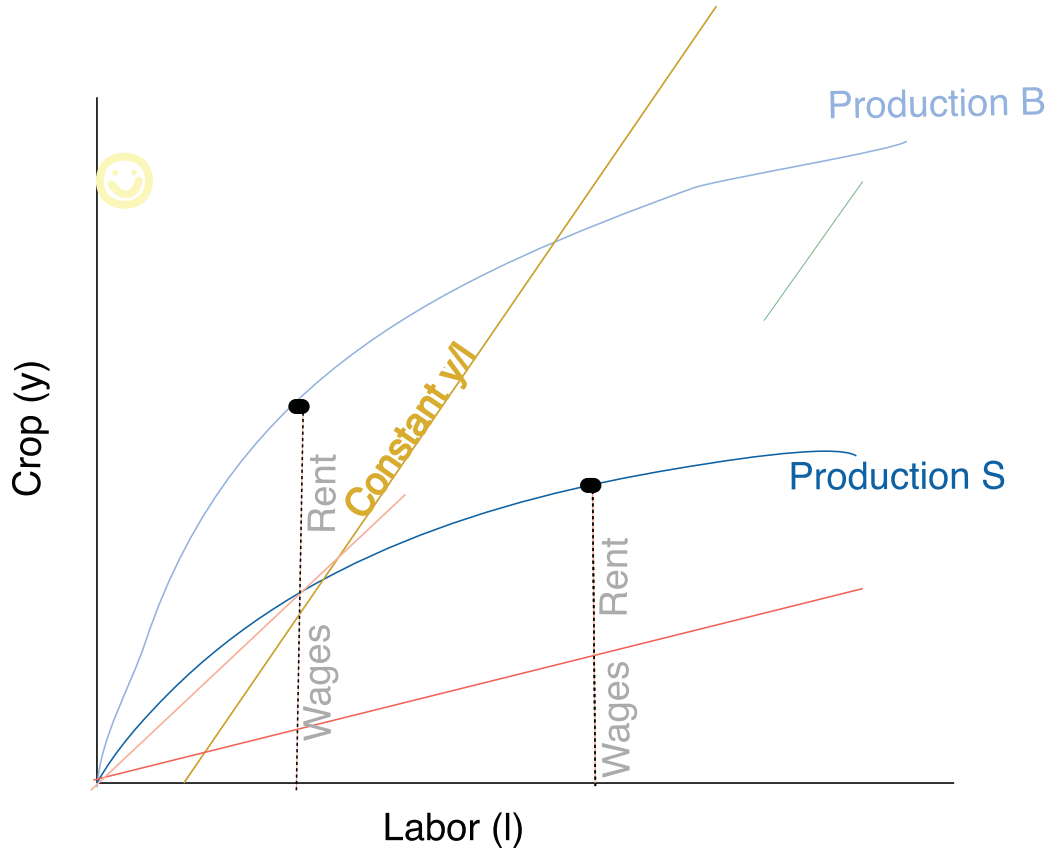
Output and labor use for small and big farms



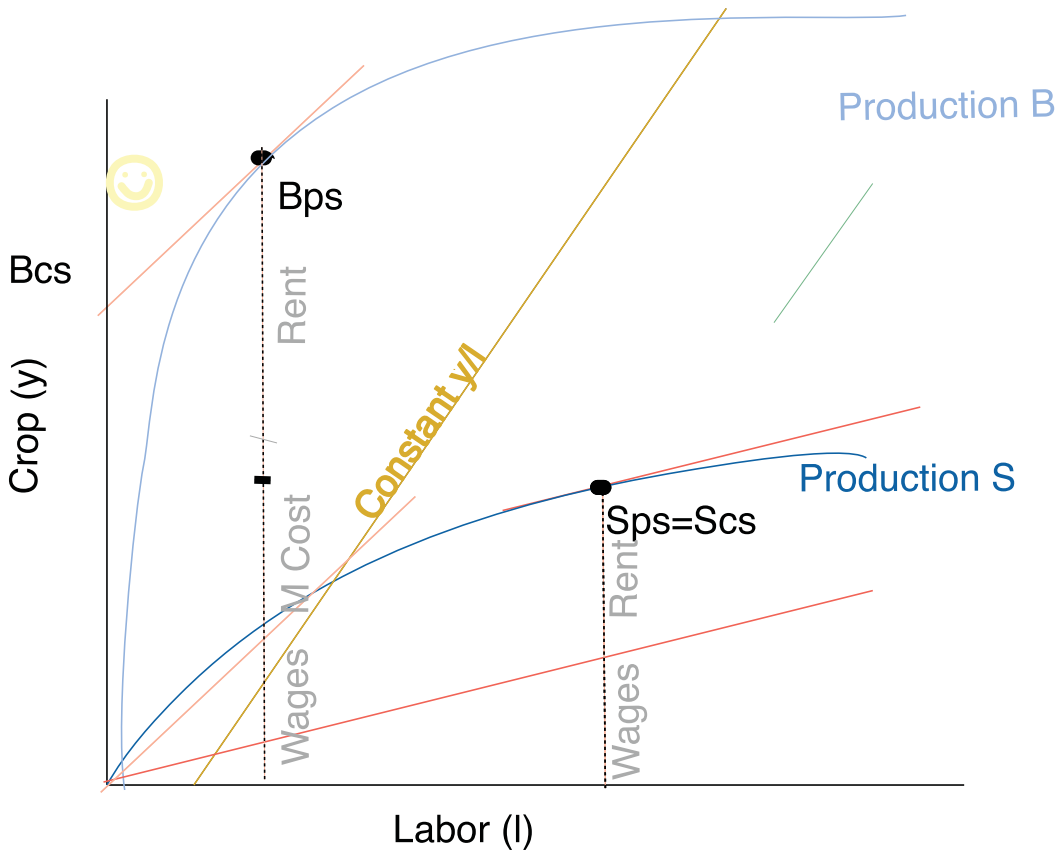
Output and labor use for small and big farms



Output and labor use for small and big farms



Output and labor use for small and big farms



Key equations

- $g_{ei} e_{il} = w_i^r = \frac{1+s_f}{1-h_i(s_f-s_h)} w_i$
- $h_i = \begin{cases} 0 & \text{family working off farm} \\ 1 & \text{hiring workers in} \\ [0..1] & \text{neither hiring in or out} \end{cases}$
- $\nu = \pi(a) + a \frac{d\pi(a)}{da}\Big|_{h_i}$
- $\underline{\nu} = \nu + \sum_i (w_i^r - \underline{w}_i)(l_f + a\frac{dl_f}{da})$

Main data sets

- 2007-8 Rural Economic Development Survey (REDS 2007-8)
- 1999 REDS both carried out by the National Council of Applied Economic Research (NCAER).
- 17 of the major states of India, with Assam and Jammu and Kasmir the only major states excluded.
- Original 1968-69 representative with over sampling of better off households.

Sample sizes

- Listing 120,000 households,
- 2007-8 household survey includes 4,961 crop cultivators who own land.
- Panel households 2,848 panel households (1999 and 2007-8)
- Data on 10,947 plots most for multiple seasons,

Land Transactions

- Only 4.6 percent of cultivated plots, over the three seasons, are rented (4.9 percent of area).
- 72 percent from parents and siblings (except in West Bengal where 94 percent from other or landlord)
- Only 5 percent of panel farmers sold land over 1999-2007 panel
- Of these 95 percent of sales to family members

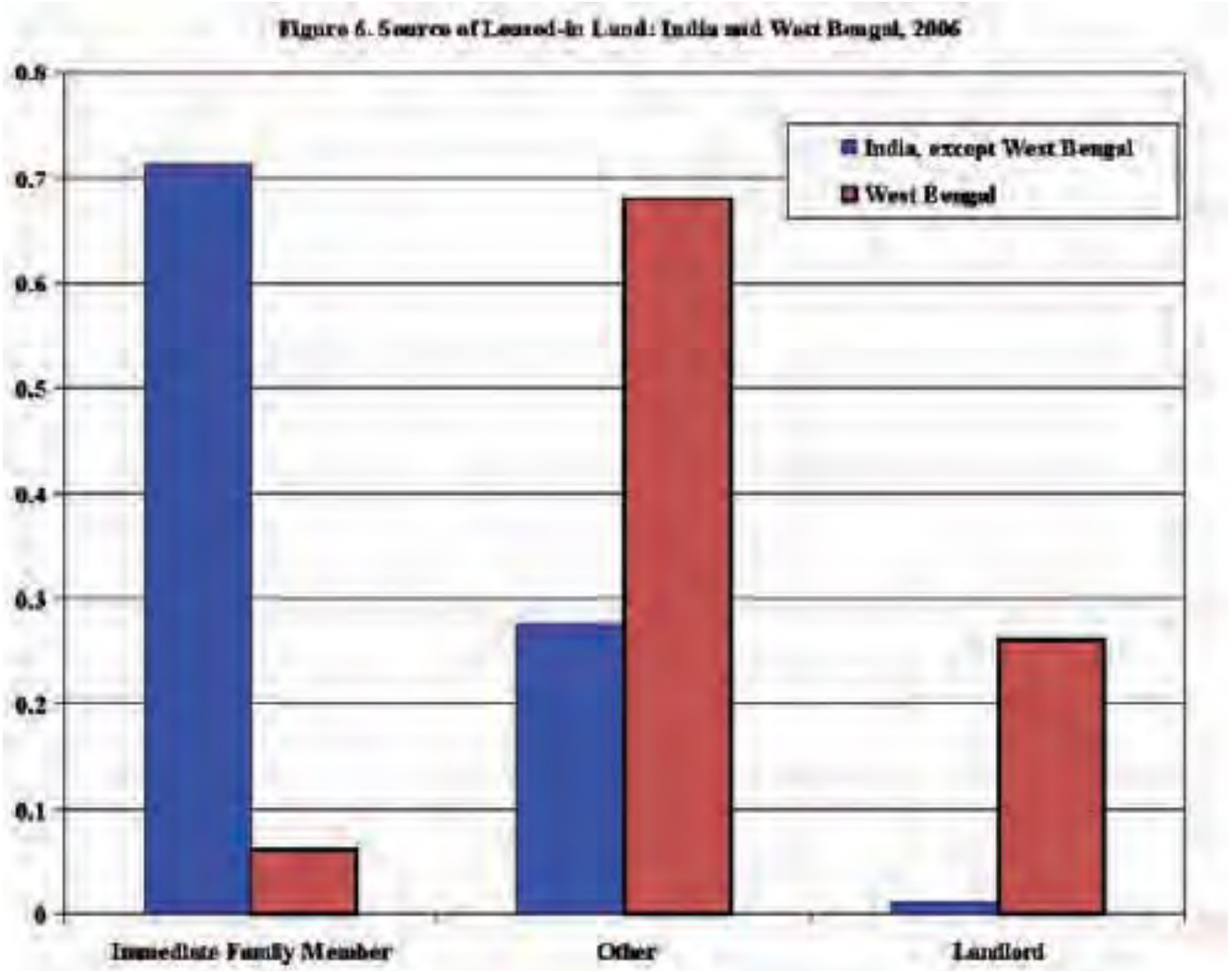


Figure: Landlord tenant relations

Identification

- Use overtime inheritance and family division to see effects of land size changes on scale
- Use across-plot variation for same farmer to remove scale effects from credit and labor cost
- Use multiple-plots over time to distinguish credit shock effects from nutrient depletion effects

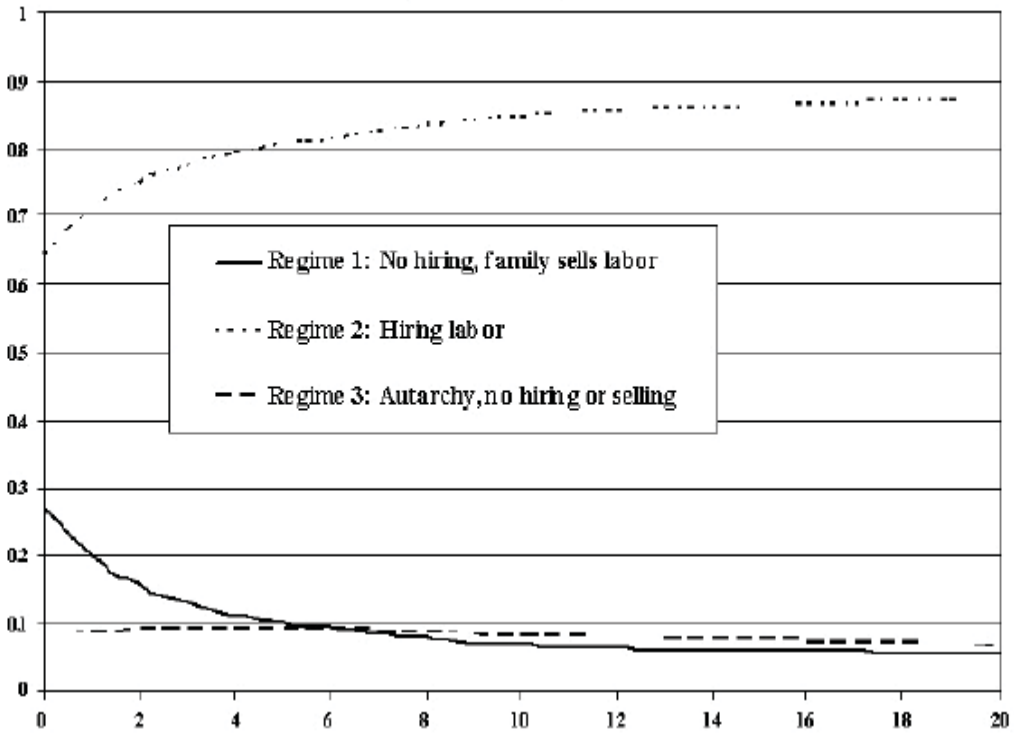
Supervision

Table 1. Panel Data Estimates (1999-2008): Effects of the Use of Hired and Family Labor on Supervision Time (Adjusted Mandays), by Estimation Procedure

Estimation procedure:	OLS	Farmer Fixed-Effects[a]	Farmer Fixed-Effects-IV
Hired labor mandays, adjusted for sex/age	.0906 (2.62)	.0977 (3.39)	.573 (2.81)
Family labor mandays, adjusted for sex/age	.170 (2.96)	.0844 (2.41)	.138 (2.10)
Test statistic, H_0: supervision costs= $\chi^2(1)$, p-value	0.89 (.345)	0.02 (.812)	3.76 (.0525)
Number of observations	3,280	3,280	3,280
Number of farmers	1,640	1,640	1,640

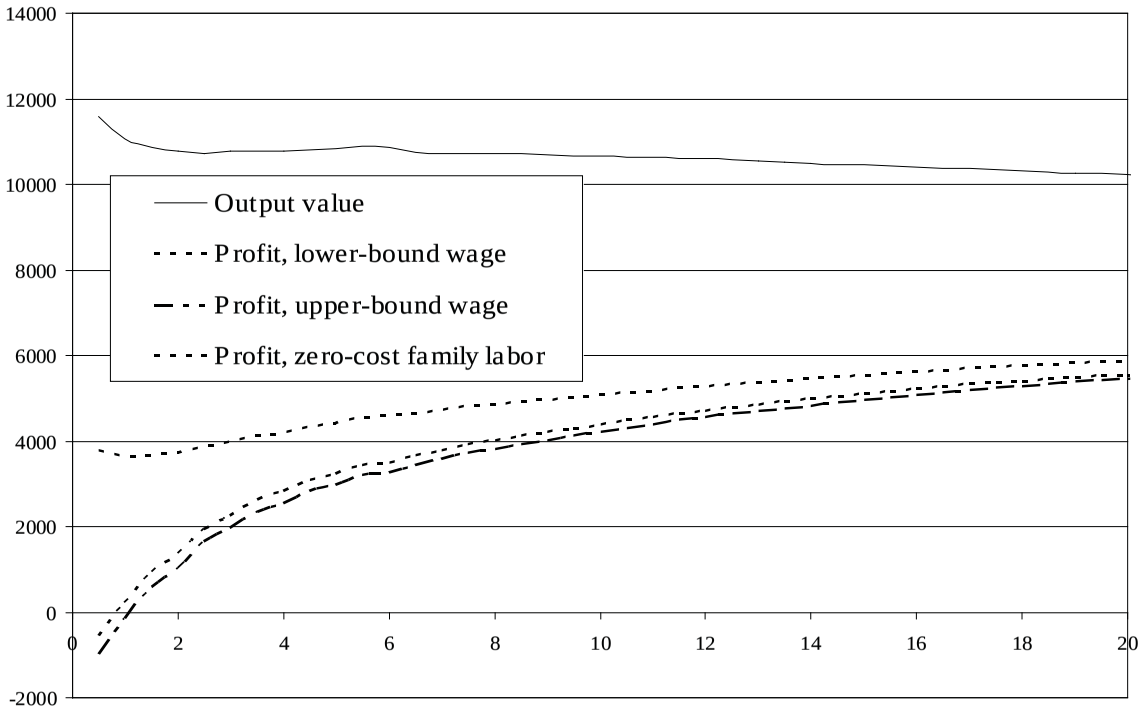
Labor utilization regimes

Figure 2. Fraction of Agricultural Labor Employed in Three Labor Regimes, by Landholding Size

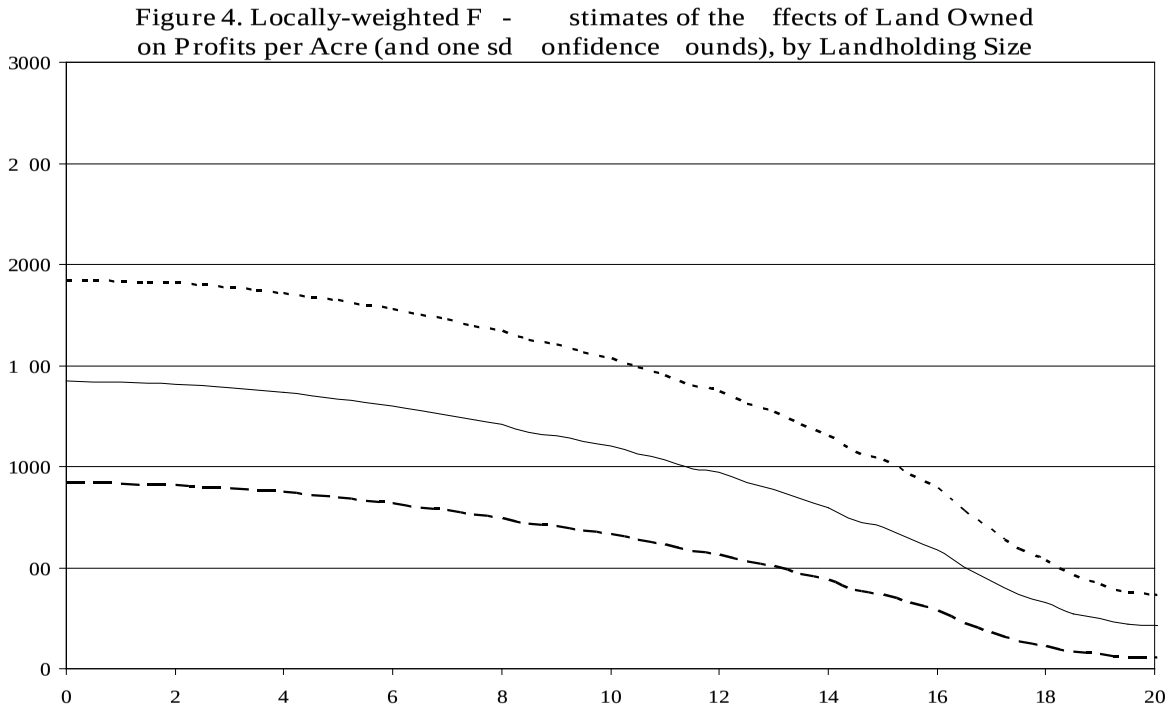


Adjusted Profits

Figure 3. Measures of Per-Acre Productivity, by Owned Landholding Size (2007-8)



Marginal Effects of Land on Profits



Cross-plot evidence of pure-scale effects

Table 4. Within-Farmer/Season Plot-Level Estimates (2007-8):
Effects of Plot Size on Plot-Specific Profits and Labor Costs and Use of Tractor Services

	Profits per Acre			Total Labor Costs per Acre			Any Tractor Services Used[b]		
Plot area	536.3	534.9	494.8	-610.5	-615.2	-568.4	.303	.317	.286
	(4.55)	(4.54)	(4.20)	(5.49)	(5.50)	(5.21)	(2.01)	(1.93)	(1.85)
Whether plot irrigated	1564	1514	1527	-105.9	-151.9	-26.2	.962	1.01	1.01
	(2.93)	(2.84)	(2.78)	(0.17)	(0.27)	(0.04)	(2.29)	(2.25)	(2.18)
Formal equipment rental market in village*area	-	-	713.5	-	-	-770.4	-	-	.0662
			(1.73)			(2.09)			(0.14)
Include soil characteristics?[a]	N	Y	Y	N	Y	Y	N	Y	Y
Number of plot observations	16,544	16,544	16,544	16,544	16,544	16,544	16,544	16,544	16,544
Number of farmers	7,845	7,845	7,845	7,845	7,845	7,845	7,845	7,845	7,845

Absolute value of asymptotic t-ratios in parentheses clustered at the village level. [a]Soil characteristics include depth, salinity, percolation and drainage; five soil colors (red, black, grey, yellow, brown, off-white); five soil types (gravel, sandy, loam, clay, and hard clay). [b]ML conditional logit estimates.

Cross-plot evidence of credit effects

- $v(h_t^*, n_t^*) =$
  $max E_t(\theta_t + g(f_t^* + n_t^*) - r(f_t^* - h_t^*) - h_{t+1}^* + \beta v(n_{t+1}^*, h_{t+1}^*)$
- $h_{t+1}^* = h_t^* + \lambda(\theta_t - E_t\theta_t)$
- $n_{t+1}^* = n_t^* + f_t - \alpha n_t$
- $d\pi_{t+1}/d\theta_t = -\alpha\kappa_{t1} + \lambda\kappa_{t2}$

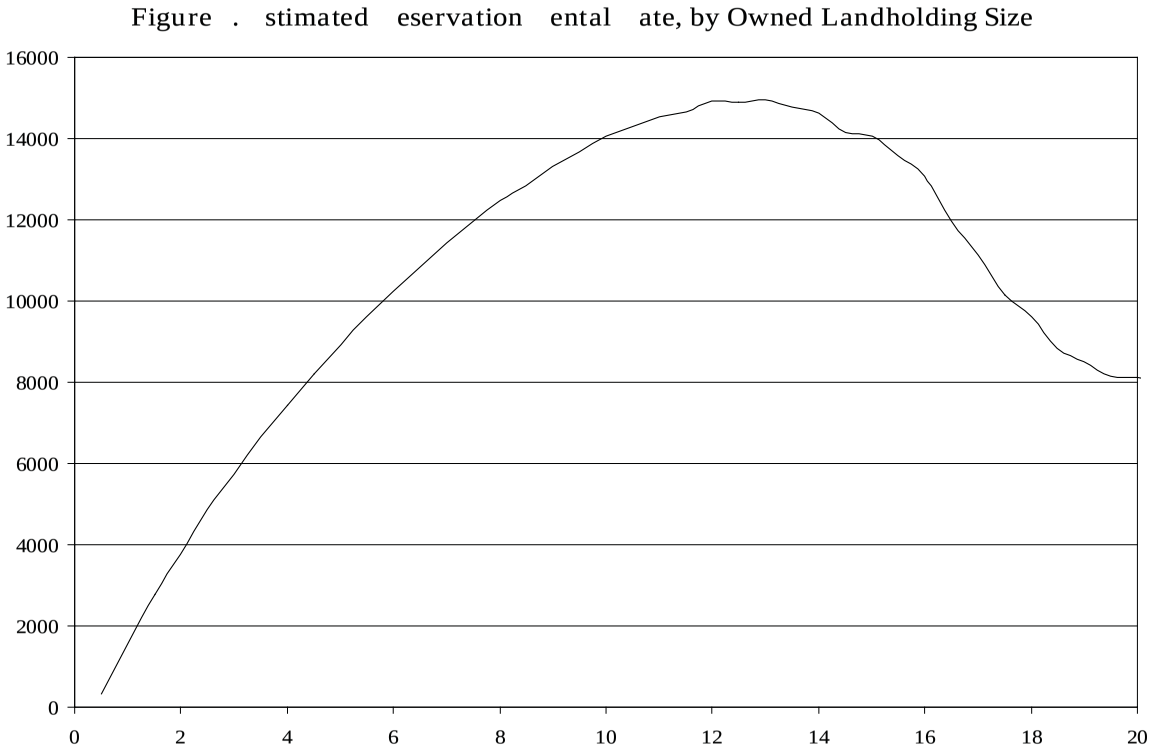
Cross-plot evidence of credit effects II

Table 5. Within-Plot Estimates Across Three Seasons (2007-8):
Effects of Previous-Period *Farm-Level* Profit Shocks on *Plot-Level* Current Profits per Acre, by Owned Landholding Size

Farm size:	Owned Landholdings<4	Owned Landholdings>=4, <10	Owned Landholdings>=10
Farm profits per acre, all other plots, previous season	.0848 (2.10)	.112 (1.45)	-.0426 (0.62)
Farm profits per acre, this plot, previous season	-.479 (8.25)	-.549 (5.01)	-.540 (3.01)
Fertilizer use, this plot, previous season (value per acre)	1.14 (2.15)	.777 (2.11)	.363 (2.72)
Number of plot observations	5,802	3,060	1,964
Number of farmers	3,595	1,967	1,234

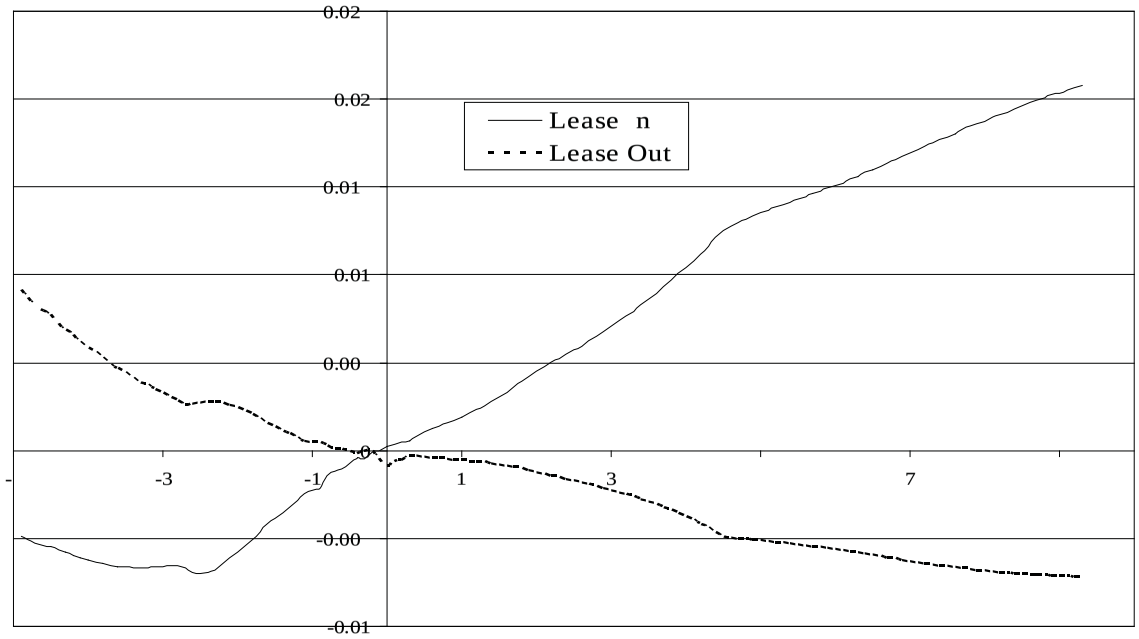
Absolute value of asymptotic t-ratios in parentheses clustered at the farm level. Specifications include season*village dummy variables.

Willingness to pay

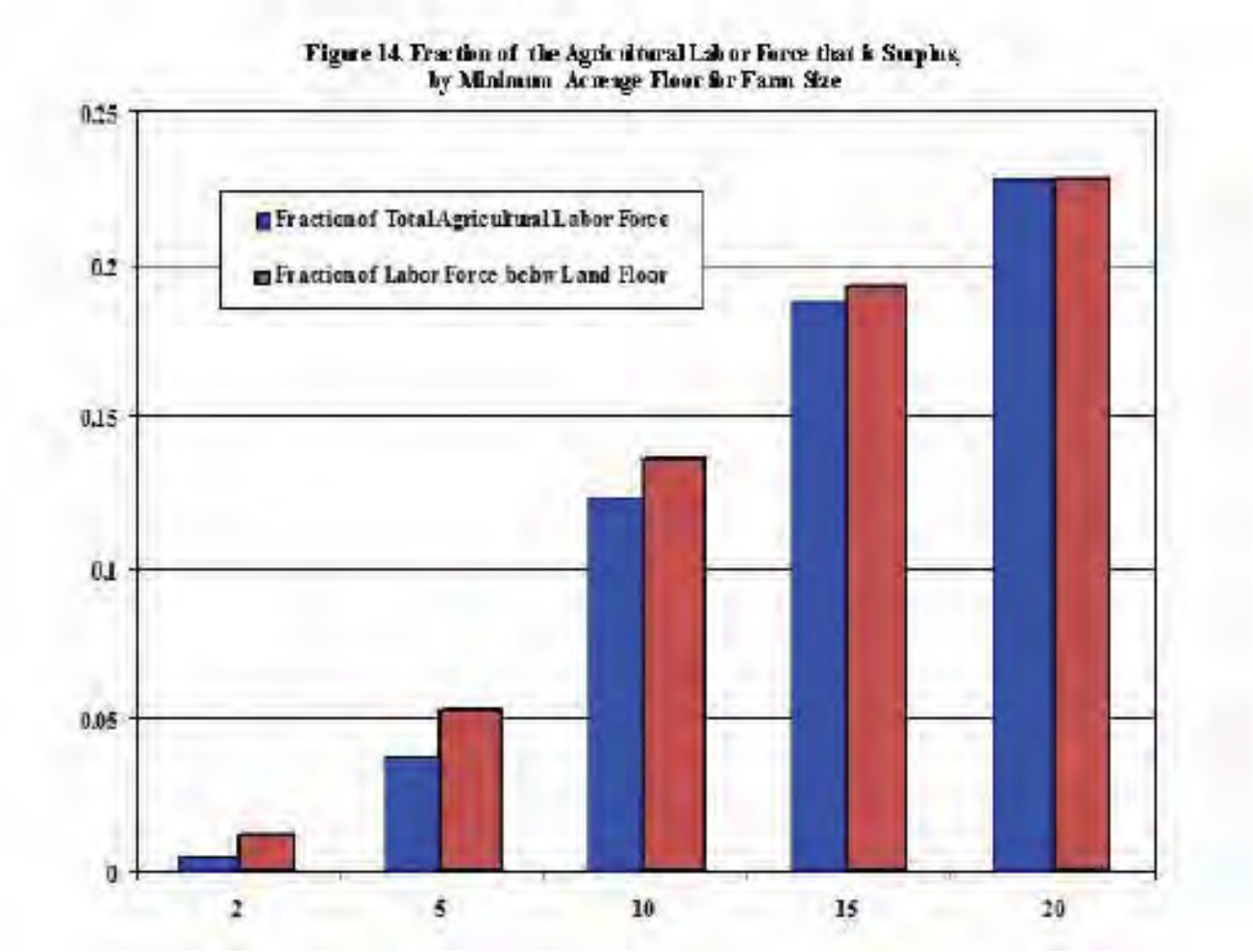


Reverse tenancy

Figure 6. ithin- illage elationship etween the Probability of Leasing n and Leasing out Land, by Ownership oldings (11 ,34)



Labor released by hypothetical land floor



So far

- Evidence of substantial gains on financial grounds for land consolidation
- But land consolidation gets cost advantages in part through labor displacement
- But potential for declines in wages raises important concerns for equity and efficiency
- How can the economy productively absorb this labor?
- Urban sector plus non-farm rural activity

Distribution of work

Table 1
Establishments and Employment in ARIS-REDS Villages, India, 2007

Establishment type	Activity type	Fraction of villages with workers employed in this type of establishment	Average village employment of this type among villages with workers employ in this type of establishment
Factory	Manufacture	0.53	26.4
Lime kiln	Manufacture	0.08	8.4
Brick kiln	Manufacture	0.59	25
Bakery	Service	0.64	5.2
Bicycle Repair	Service	0.98	3.7
Vehicle Repair	Service	0.84	5.3
Tea Shop	Service	0.98	8.2
Eating House	Service	0.85	7.4
Tailor	Service	0.99	5.4
Blacksmith	Service	0.92	3.3
Mason	Service	0.88	13.0
Carpenter	Service	0.97	5.7
Cobbler	Service	0.62	2.7
Potter	Service	0.59	6.3
Handicraft	Service	0.19	6.5
Washerman	Service	0.85	6.8
Barber	Service	0.99	4.7
Cinema	Service	0.49	3.1
Vegetable shop	Service	0.93	6.5
Grocery Shop	Service	0.95	6.8
Public Call Office	Service	0.96	6.7
Weaver	Value added	0.22	45.1
Grain Dryer	Value added	0.21	10.0
Rice Huller	Value added	0.68	6.2
Flour Mill	Value added	0.89	3.5
Raw Sugar (Gur)	Value added	0.18	28.5

Agricultural growth and non-farm income

Table 5
FE-IV Household Panel Estimates: Determinants of Non-agricultural Income, by Type

Variable	Non-farm W&S	Business	Total Nonfarm
Log HYV yield index[a]	-1388.1	1248.0	-161.4
	(2.18)	(2.07)	(0.24)
Besley-Bugess index of state regulations on urban factory labor	127.3	17.6	158.7
	(1.66)	(0.26)	(1.84)
Household size[a]	315.9	181.5	474.9
	(3.79)	(2.95)	(4.18)
Owned land (hectares)[a]	1.35	-12.5	-7.40
	(0.06)	(0.52)	(0.19)
Household nonland wealth, excluding house (1982 rupees)[a]	.0190	-.0350	-.00994
	(0.69)	(1.17)	(0.29)
Village near organized market (<10km)	82.9	-120.0	41.3
	(0.28)	(0.48)	(0.15)

Agricultural growth and non-farm activity

Table 3
FE-IV Village-Level Estimates:
Effects of Agricultural Productivity Growth and Urban Regulations Governing Factory Labor on Rural Nonfarm Business Activities, by Type

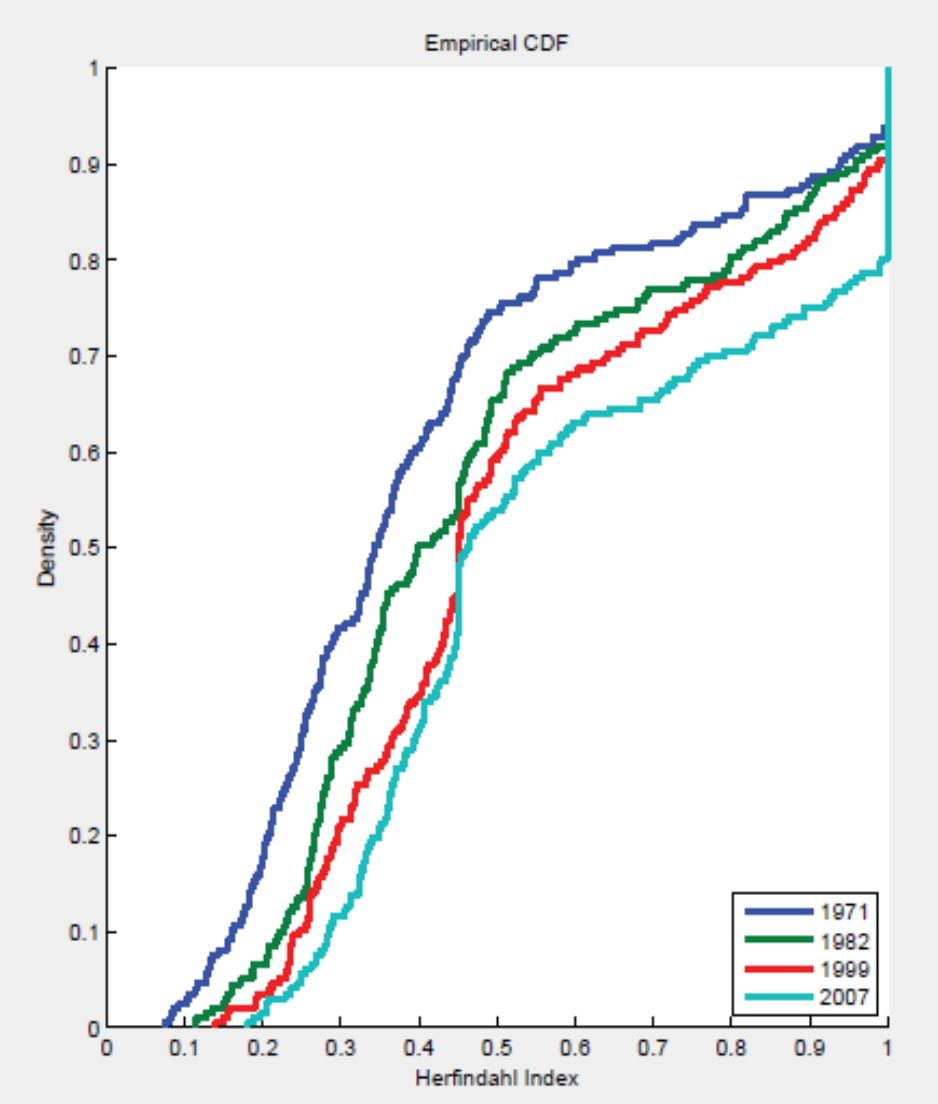
Variable	Log of Number of Village Service Enterprises	Log of Number of Village Factory Workers
Log HYV yield index[a]	.551 (1.87)	-1.27 (2.01)
Besley-Burgess index of state regulations pertaining to urban factory labor	-.0971 (2.25)	.173 (2.04)
Village electrified	.0147 (0.06)	.764 (1.83)
Village near organized market (<10km)	-.0267 (0.17)	-.0937 (0.30)
Average village wealth($x10^{-4}$)[a]	-.239 (1.27)	.627 (1.55)
Log of village population size	.00764 (0.32)	.0528 (1.14)
Number of public secondary schools in village	.0252 (0.14)	-.322 (0.74)
Time	.187 (0.69)	1.30 (2.12)
N	454	454

Non-farm employment and wages

Table 6
Village-Level Estimates: Effects of Agricultural Productivity Growth and Industrialization on Log Rural Wage[a]

Variable	GLS	FE	FE-IV
Log HYV yield index[b]	.187	.269	.274
	(6.64)[c]	(5.97)	(1.97)
Log of number of village factory workers[b]	.0802	.0692	.0927
	(8.06)	(4.67)	(1.78)
Log of population in village	.00444	-.00756	-.0201
	(0.63)	(0.76)	(1.95)
Village wealth ($x10^{-5}$)	.576	.315	.387
	(2.70)	(0.83)	(0.50)
Number of public secondary schools in village 10 years ago	.0262	.183	.0913
	(0.97)	(2.66)	(1.16)
N	444	444	444

Village Crop-specialization by Year



Factory non-farm employment

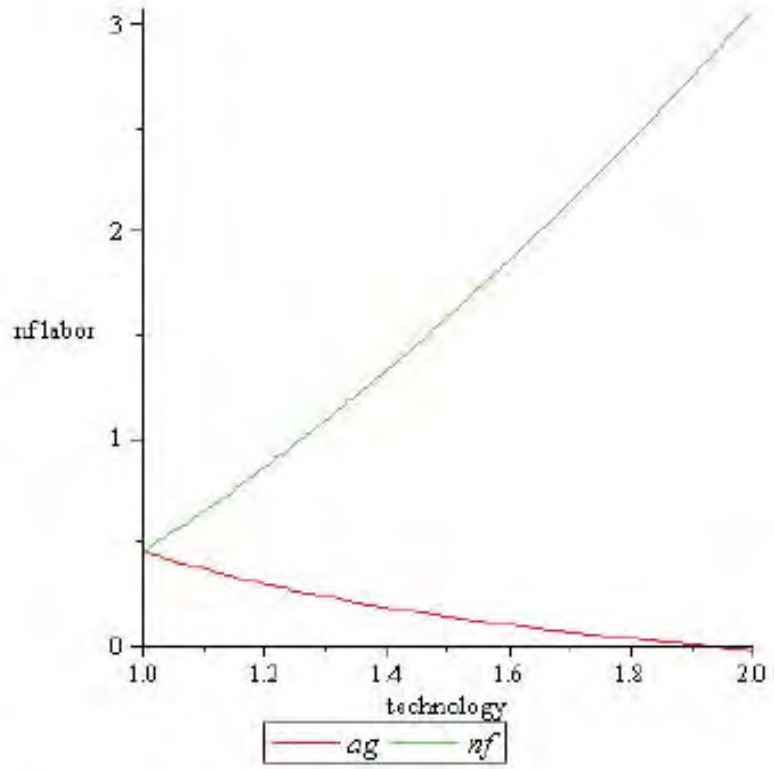


Figure 2: Simulated effects of agricultural and factory technology on factory employment

Value added non-farm employment

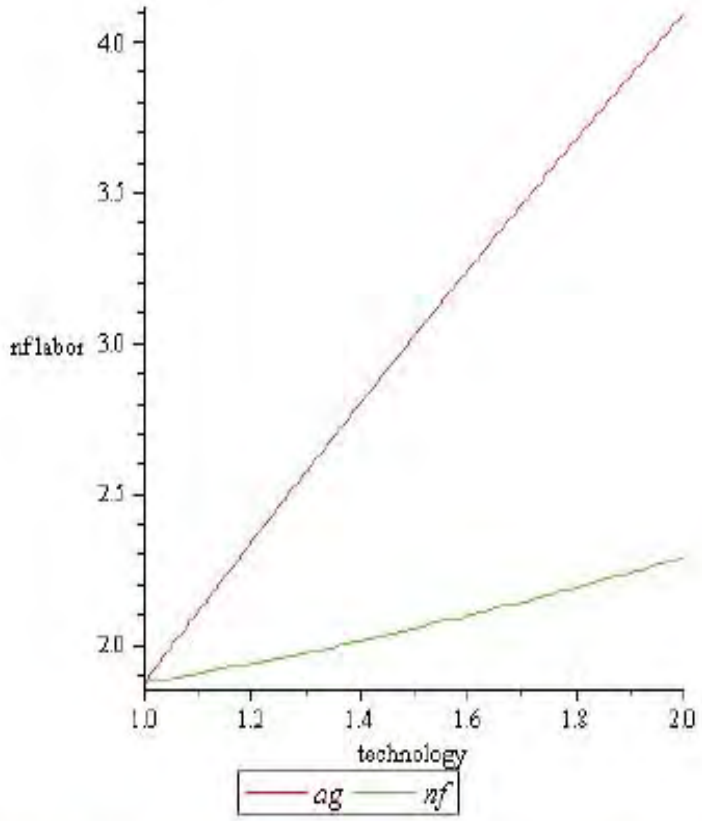


Figure 6: Simulated effect of agricultural and value-added technology on value-added employment

Income quantiles and village employment by type

Table 3
Random Effects Estimates of Relationship between log income quantile, sources of income and Infrastructure

	10%	25%	50%	75%	90%
Traded Workers/Cap	0.133	0.172	0.219	0.274	0.263
	(0.75)	(1.05)	(1.37)	(1.70)	(1.63)
Service Workers/Cap	-0.034	0.051	0.009	-0.091	-0.246
	(0.23)	(0.36)	(0.07)	(0.67)	(1.79)
Value-added Workers/Cap	2.655	2.172	2.140	2.859	2.919
	(3.63)**	(3.22)**	(3.27)**	(4.31)**	(4.41)**
Ln Yield	0.105	0.123	0.134	0.149	0.133
	(3.19)**	(4.03)**	(4.52)**	(4.94)**	(4.42)**

Conclusions I

Substantial potential to release labor from agriculture and raise per worker productivity and per acre productivity.

- This is not due to labor market problems but to thinness of land market coupled with scale economies from mechanization and credit.
- In keeping with long tradition of thinness in land markets and high share of land transactions–both rental and sale–that are within family
- Even if per-acre profitability of small farmers were the same, not clear that would remain so as wages rise through development
- However, increases in scale without other opportunities and ability to hold assets would have substantial adverse impact on poor through labor market

Conclusions II

Key issue is what barriers are to consolidation/amalgamation

- Thinness of land markets
- Need for contiguous plots
- Poor have a collective incentive to reduce amalgamation
- Credit markets (value of land is tied to consolidation)
- Alternative mechanisms to store wealth/hedge risk
- Weak political/legal institutions
- Other non-financial barriers to land transactions

Conclusions III

Consolidation requires expansion of opportunities in both rural and urban areas for next generation

- Non-farm rural activity is expanding but also at low scale
- There is a particularly high return to expansion in value-added productivity but this seems relatively scarce in India.
- It is possible that public intervention in grain markets and poor infrastructure are a barrier to increased specialization and development of value-added production