Land Misallocation and Productivity

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Motivation

- Why are some countries richer than others?
- Many useful perspectives. We focus on two dimensions:

(a) Agriculture is important in accounting for productivity differences across countries:

- poor are much less productive in agriculture than in non-agriculture relative to rich countries
- low productivity in agriculture means more people in agriculture to satisfy subsistence consumption
- Challenge: why are poor countries so much less productive in agriculture?...

(b) Misallocation of factors across heterogeneous production units have a role explaining productivity levels.

- We argue that land (mis)allocation is important for agricultural productivity.
- We focus on Malawi. Why?
  - **Land markets are restricted and underdeveloped**: Most land is either inherited (73%) or granted by local chiefs 11.9%). Only 1.1% of land is purchased (with a title) and only 6.9% is rented.
  - We have detailed representative household-farm data to identify farm-level productivity.

What We Do and Find

1. We **estimate farm-level productivity** using unique micro data from household-farms in Malawi. From unique and very detailed data on farm output and inputs.
   - We capture the full degree of heterogeneity in land quality & rain.
   - Development accounting: **Negligible role of quality & rain**.
2. We find **empirical evidence of misallocation**: yield and capital productivity are strongly positively related to productivity.
3. We **assess the impact of misallocation** for agricultural productivity with a simple efficient framework:
   - Counterfactual: If land is efficiently reallocated **agricultural productivity increases by 3 times its value**.
   - Our result is robust to within narrow definitions of geographical areas, traditional authority, language, human capital.

The Micro Data: Malawi ISA 2010

- New and unique nationally-representative household data, World Bank (see de Magalhaes and Santaeulalia-Llopis, 2014).
- The original sample includes 12,271 households of which about 81% live in rural areas.
- The survey follows a stratified 2-stage sample design.
  1. 768 enumeration areas (EAs) were selected with PPS within each district..
  2. Random systematic sampling was used to select 16 primary households and 5 replacement households from the household listing for each EA.
- Very detailed information on inputs and outputs makes this dataset ideal for our exercise.
- Sample is rolled over 12 months from March 2010 to March 2011. Sesonality is accurately addressed.

The Micro Data: Malawi 2010 ISA: A Snapshot

- Agricultural Production: 70% of all income in rural Malawi. Rainy seson 93% of total crop. Maize represents 78% of total production. Resolve issues of physical units conversion to estimate the unsold production.
- Land: Info on each cultivated household plot (owned plus rented-in). Average plots per household-farm are 1.8. Size accurately measured via GPS. The sum of all operated plots is land size.
- Capital: Full array of capital types. Equipment: inlcudes implements (hand hoe, etc.) and machinery. Structures: includes chicken houses, livestock kraals... etc. We use the selling price.
- Hours: Most households members work in the field (size=4.57). Individual info on extensive and intensive margins of labor supply: (*i*) weeks worked, (*ii*) days/week, and (*iii*) hours/day by plot & by agricultural activity:
  - land preparation/ planting,
  - weeding/fertilizing, and
  - harvesting and by season (rainy, dry and permanent).

Measurement Error

Fact 1: Operational scale extremely small

Percentage of Farms by Size Class

Hectares	Malawi (cum)	Belgium (cum)	USA
≤ 1 Ha	77.7	14.6	–
$1-2$ Ha	17.3	8.5	–
$2-5$ Ha	5.0 (100)	15.5 (38.6)	10.6
$5-10$ Ha	0.0	14.8	7.5
$10+$ Ha	0.0	46.6	81.9
Average Farm Size (Ha)	0.7	16.1	187.0

Notes:Data for Belgium and USA from the 1990 Census.

- In acres, 40% of Malawi's farmers have <1, 73%<2, 90<3, 95%<4.
- Variance of logs is .618, 90/10 is 7.67, 75/25 is 2.78, Gini .50.

Fact 2: Most production goes to consumption

- Food insecurity last 12 m is on aveage 50.6% (top 10% of agri. production face 28%, bottom 10% face 80.7%). High food consumption/ag. production. 67% of all consumption is food.

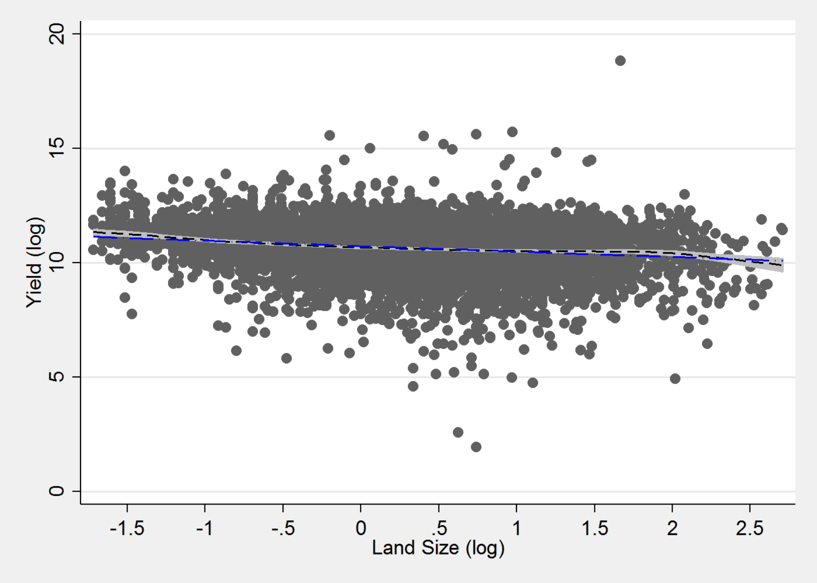
Fact 3: Farms use land at (almost) full capacity

- We include owned plots, and rented-in plots. There are 283 rural households without plots. The total share of land that is not cultivated is: less than 3%. Some left fallow.

Fact 4. Evidence by Farm Size:

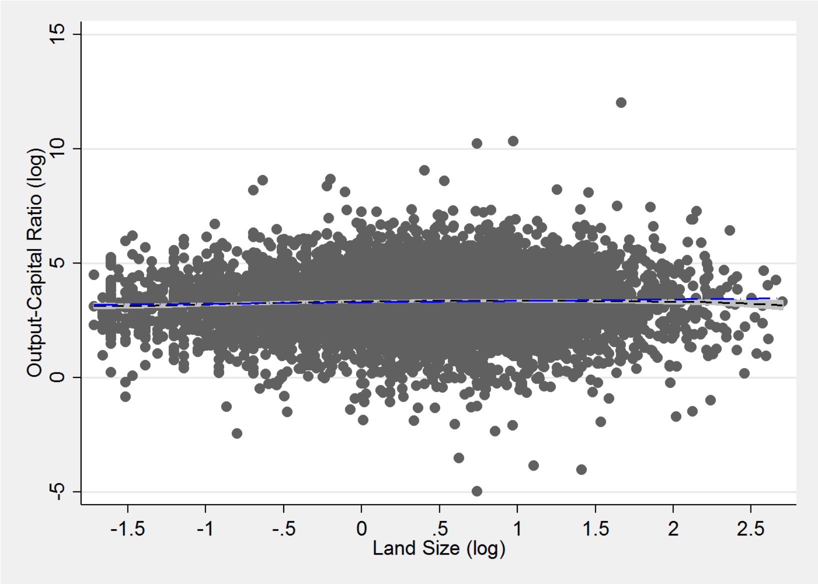
- Fact 4.1: Capital increases with farm size
- Fact 4.2: Capital-land ratio is roughly constant across farm size.
- Fact 4.3: Yield (output per unit of land) weakly declines with farm size.
- Fact 4.4: Capital productivity (output per unit of capital) is roughly constant with farm size.

Fact 4.3 Yield vs. Farm Size



Notes: The correlation is -.18 (N -.28, C -.08, S -.33).

Fact 4.4 Capital Productivity vs. Farm Size



Notes: The correlation is .03 (N .08, C .00, S -.02).

Fact 5. Evidence by Farm Productivity:

We identify household farm productivity s_i as the unobservable s_i in

$$y_i = s_i \zeta_i k_i^{\theta_k} (q_i l_i)^{\theta_l} \quad (1)$$

where θ_x are input factor shares.

- ζ_i represents unanticipated shocks (e.g. rain), and
- q_i is an index of land quality.

Land Quality Dimensions

VERY detailed information on the land quality per plot (and household). We use full set of 11 dimensions reported in ISA.

1. Elevation
2. Slope
3. Erosion
4. Soil Quality
5. Nutritient Availability
6. Nutritient Retention Capacity
7. Rooting Conditions
8. Oxygen Availability to Roots
9. Excess Salts
10. Toxicity
11. Workability

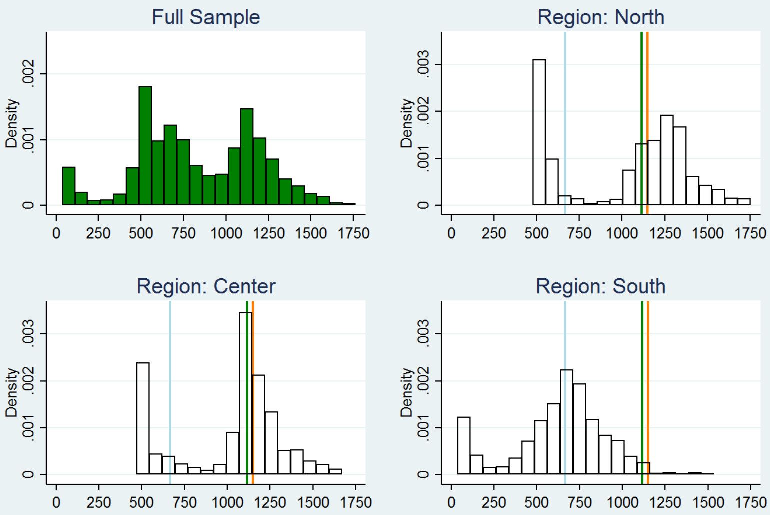
Land Quality Dimensions (continued)

Farm heterogeneity in terrain roughness (elevation and slope):

	Full Sample			Regions North	Regions Center	Regions South
	Type	Elev.	Slope	Type		
Lowlands	1.03	132	5.98	.00	.00	2.16
Rugged Lowlands	.11	106	16.23	.00	.00	.24
Plains	4.92	86	1.71	.00	.00	10.33
Mid-altitude Plains	8.31	474	1.76	8.85	8.73	7.81
High-altitude Plains	34.88	873	2.34	23.24	46.63	30.55
Platforms (very low plateaus)	2.11	401	6.19	1.40	.23	3.74
Low plateaus	20.57	727	6.46	14.62	7.56	32.28
Mid-altitude plateaus	19.25	1,218	6.55	34.65	32.09	4.19
Hills	.62	381	16.83	.29	.00	1.20
Low Mountains	3.38	769	15.98	3.90	.26	5.48
Mid-altitude Mountains	4.82	1,314	16.59	13.05	4.50	2.03
	100.00	834	5.29	100.00	100.00	100.00

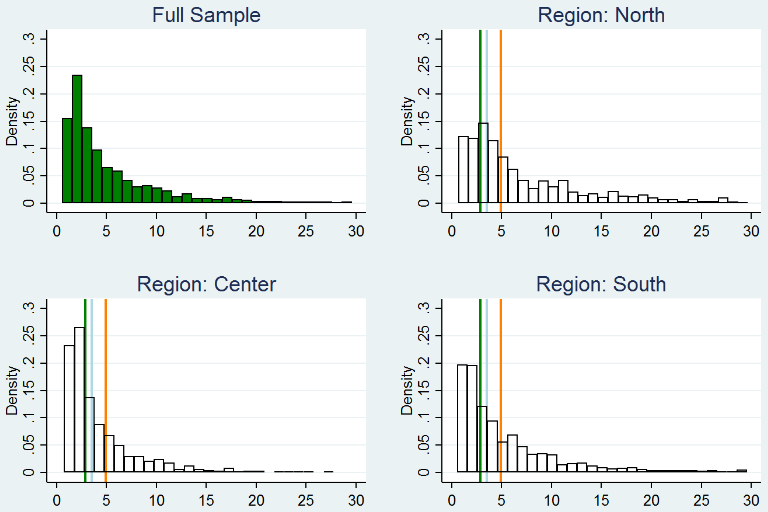
Notes: Elevation is in meters and slope is in %.

Elevation (meters), Malawi ISA-2010/11



Notes: Median values in orange (North), green (Center) and blue (South).

Slope (in %), Malawi ISA-2010/11



Notes: Median values in orange (North), green (Center) and blue (South).

More dimensions of land quality: Empirical properties

Land Quality Index, q_i

- Our benchmark land quality index:

$$q_i^0 = g(\overline{q}_i)$$

where the vector $\overline{q}_i$ for household i contains the following 11 land quality dimensions

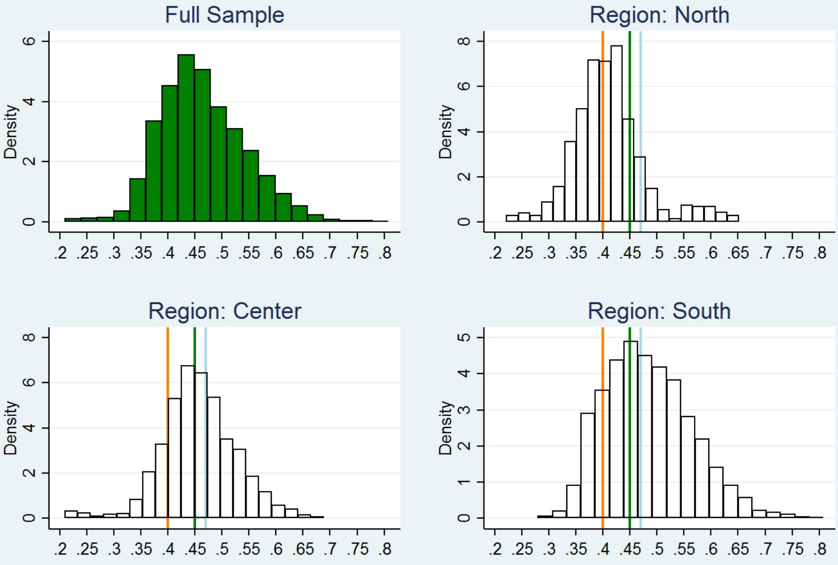
$$j = \{sl, ele, ero, sq, na, nc, rc, oar, exs, tox, w\}$$

and,

$$g(.) = \Pi_{j=1,n} q_j^{\omega_j},$$

where $n = 11$ and $\omega_j = \omega \, \forall \, j$.

Land Quality Index q_i, Malawi ISA-2010/11



Notes: Median values in orange (North), green (Center) and blue (South).

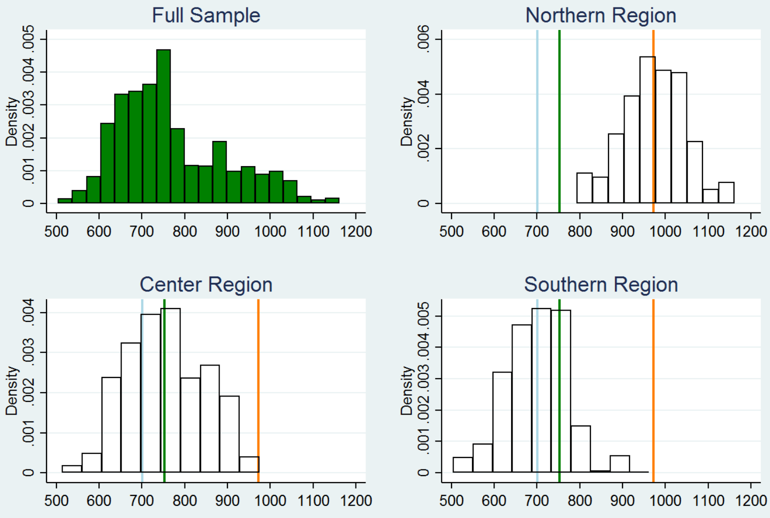
Dispersion (Variance) of Land Quality vs. Land Size

		By Geographic Aggregation Level:		
	Full Samp.	Regions	Districts	Enum. Area
Land Size, L_i:	.618	.595	.545	.488
Land Quality Index:				
q_i^0	.029	.026	.019	.004
Land Quality Items:				
Elevation	.439	.349	.075	.001
Slope (%)	.657	.635	.453	.093
Erosion	.188	.187	.175	.162
Soil Quality	.156	.155	.144	.133
Nutritient Avail.	.190	.162	.099	.007
Nutritient Ret. Cap.	.119	.105	.068	.005
Rooting Conditions	.209	.195	.161	.013
Oxygen Avail. to Roots	.079	.079	.059	.003
Excess Salts	.031	.031	.029	.002
Toxicity	.022	.022	.021	.001
Workability	.226	.201	.154	.014

Notes: All variables have been logged.

Quality-Adjusted Land GAEZ

Rain Shocks, ζ_i



Notes: Median values in orange (North), green (Center) and blue (South).

Dispersion (Variance) of Rain Shocks, ζ_i

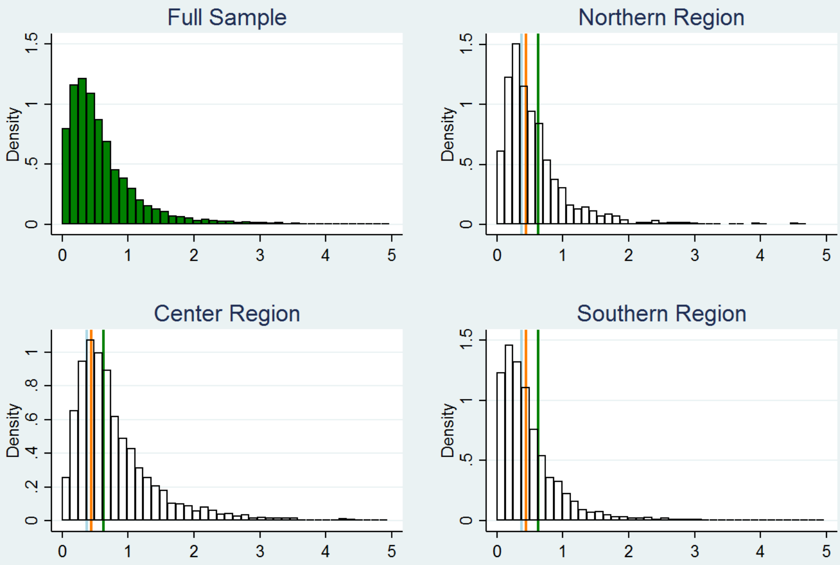
	Full Samp.	By Geographic Aggregation Level: Regions	Districts	Enum. Area
Land Size, L_i:	.618	.595	.545	.488
Rain, ζ_i:				
Annual Precip. (mm)	.025	.010	.004	.000
Precip. of Wettest Qrter (mm)	.026	.013	.005	.000
Unanticipated Rain Shocks, u_{ζ_i}:				
Annual Precip. (mm)	.008	.007	.004	.000
Precip. of Wettest Qrter (mm)	.011	.010	.004	.000

Notes: All variables have been logged.

By region, northen region has a variance in ζ_i of .005, Center .015, and Southern .009.

Rain Variables

Farm Productivity, Malawi ISA-2010/11



Notes: Median values in orange (North), green (Center) and blue (South).

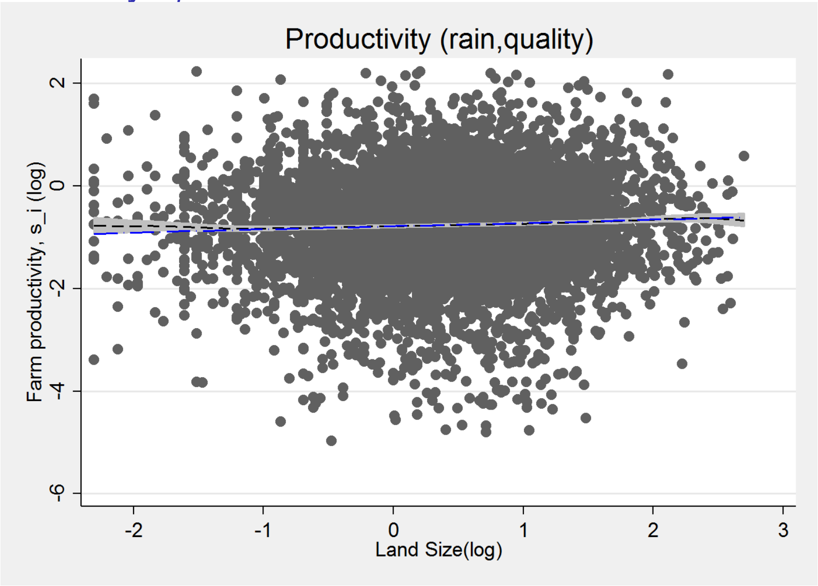
Variance Decomposition y_i

	ζ_i Yes	q_i Yes	%	ζ_i No	q_i No	%
$var(y)$		1.423	100.0		1.423	100.0
$var(s)$		.968	68.0		.937	65.8
$var(\zeta)$		.007	.5		–	–
$var(f(k, ql))$		.297	20.9		.303	21.3
$2cov(s, \zeta)$		-.012	-.8		–	–
$2cov(s, f(k, ql))$		.156	11.0		.172	12.1
$2cov(\zeta, f(k, ql))$		.003	.3		–	–

Notes: All variables have been logged.

More on Var-Decomp

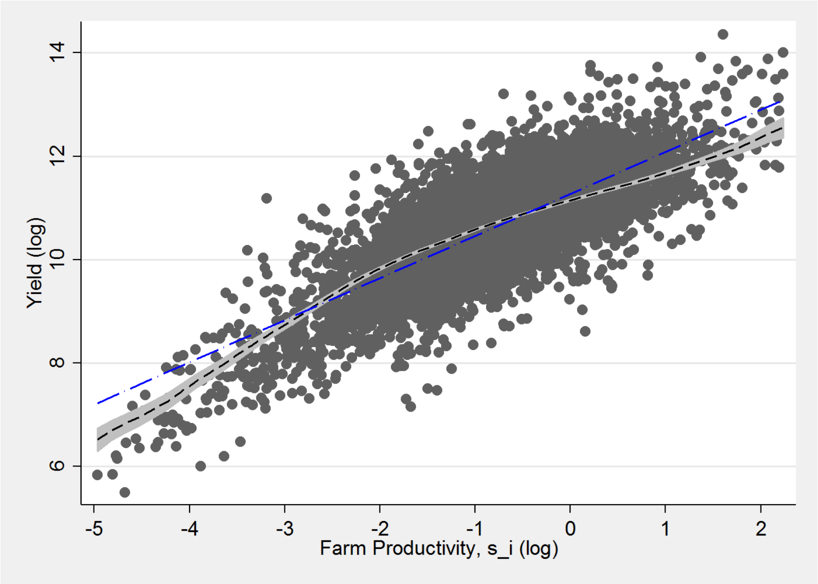
Productivity s_i vs. Land Size



Notes: The correlations b/w land size and $s(\zeta_i, q_i)$ is .04, $s(0,0)$ is .01, $s(\zeta_i, 0)$ is .09, and $s(0, q_i)$ is -.07.

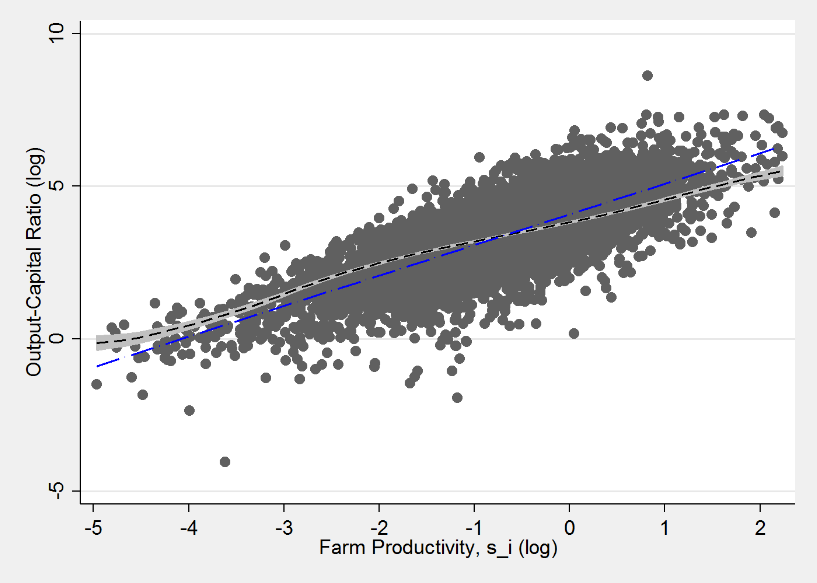
▸ More on Productivity and Land Size

Fact 5.3 Yield vs. Farm Productivity



Notes: The correlation is . 77 (N .70, C .71, S .81).

Fact 5.4 Capital Productivity vs. Farm Productivity



Notes: The correlation is . 76 (N .71, C .71, S .79).

Misallocation and Productivity

- Solve efficient allocation of capital and land across a fixed set of heterogeneous farmers
- Planner chooses allocations to maximize agricultural output given fixed amounts of capital and land

$$Y^e = \max_{\{k_i, l_i\}} \sum_i s_i (k_i^{\alpha_k} l_i^{\alpha_l})^\gamma$$

subject to

$$K = \sum_i k_i$$

$$L = \sum_i l_i$$

- Efficient allocation equates marginal products of capital and land and has a simple form, let $z_i \equiv s_i^{1/(1-\gamma)}$,

$$k_i^e = \frac{z_i}{\sum z_i} K \qquad l_i^e = \frac{z_i}{\sum z_i} L$$

Main Reallocation Result

- The output (productivity) loss is defined as

$$\frac{Y^a}{Y^e} = \frac{\sum y_i^a}{\sum y_i^e} = .330$$

  where $y_i = s_i \left(k_i^{\alpha_k} l_i^{\alpha_l}\right)^{\gamma}$, and y_i^e is evaluated at efficient allocations.

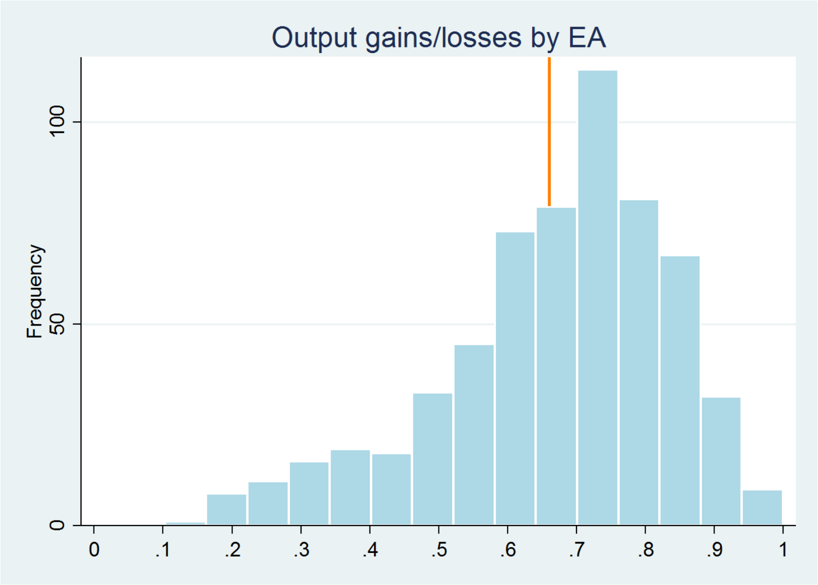
- That is, if we were to efficiently reallocate land and capital, **aggregate output would increase by a factor of 3.**

Reallocation Results: $\frac{Y^a}{Y^e}$

	Aggregate	Median	Min	Max
Nationwide	.330	–	–	–
Region	.376	.429	.232	.564
District	.436	.443	.163	.692
Traditional Authority	.546	.578	.130	.878
Language	.375	.326	.194	.818

In regions, median is Center, min is North, max is South.

Reallocation witihin EA: Land Quality Check



Reallocation within skill groups: Human Capital Check

- Schooling:

	No Schooling	Dropouts	Primary	More than Primary
$\frac{Y^a}{Y^e}$	.382	.290	.336	.463

In educ groups, no Schooling 24.83%, primary school dropouts 44.92%,primary 23.12%, and more 7.14%.

- Terrain-roughness specific skills:

	High Altitude Plains	Low Plateaus	Mid-Atitude Plateaus	Mid-Altitude Mountains
$\frac{Y^a}{Y^e}$	.262	.451	.480	.393

Actual vs. Efficient Distribution:

Productivity Partition:

	Bottom(%)			Quartiles				Top(%)		
	0-1	1-5	5-10	1st	2nd	3rd	4th	10-5	5-1	1
s_i:	.00	.00	.04	.11	.29	.47	1.95	2.80	4.03	9.67
Land:										
Actual	1.78	1.79	1.77	1.82	1.90	1.82	2.06	2.14	2.07	2.11
Eff.	.00	.00	.00	.01	.06	.17	13.30	25.67	49.54	231.02
Capital:										
Actual	2,105	2,530	5,465	6,688	8,513	4,819	3,800	3,968	2,933	2,695
Eff.	0	0	7	37	196	509	38,014	73,344	141,550	660,054
Yield:										
Actual/Eff.	.00	.00	.02	.07	.18	.26	.38	.97	1.35	3.28

More on Actual vs. Efficient Inequality

Conclusion

1. We **estimate productivity for household-farms**. Pure b/c of excellent output and input data. Also, ne of land quality & rain in Malawi. We find **little quantitative role of land quality & rain in accounting for output differentials across farms.**

2. An **efficient reallocation of capital and land across the existing set of farmers increases agricultural output and total factor productivity by a factor of 3-fold.**

3. **Similar** increase in productivity arises in reallocating **within regions, districts and much narrower enumeration areas**. Also within a wide set of factors.

4. Productivity effects can be larger when allowing for endogenous productivity investment, GE effects in the number of farms (increase in average farm size), selection, among others.

Measurement Error

- There are very few missing observations.
- Our understanding from the World Bank field managers in charge of the data collection is that this is due to the fact that respondents took the survey as 'official'.
- Internal consistency reliability checks are conducted (e.g., individuals are asked total sales, and also sales by crop; the interviewer checks that the sums coincide).
- We exclude outliers: Trimming the top and bottom 1%
- While not in our benchmark, to deal with potential recall and telescopic measurement error in agriculture production and activities we re-conduct our exercise for households that were interviewed within the three months after and including March (the harvest month).

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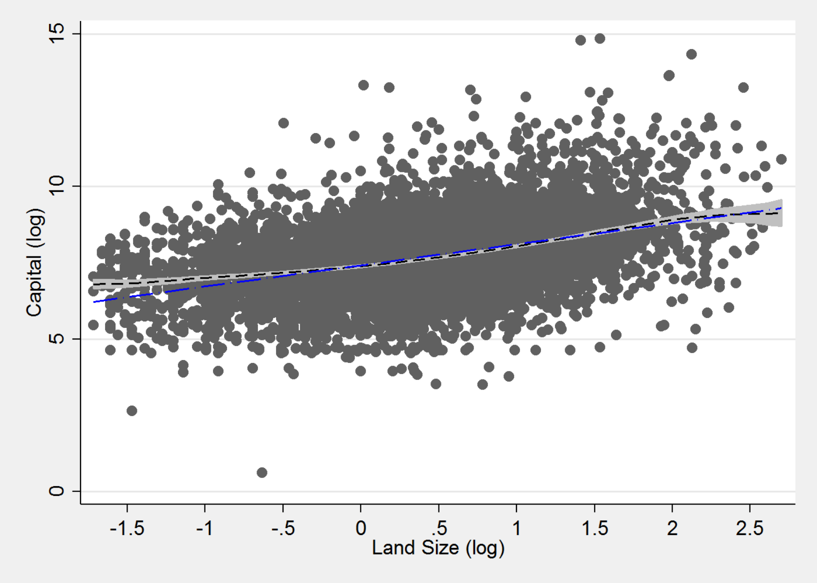
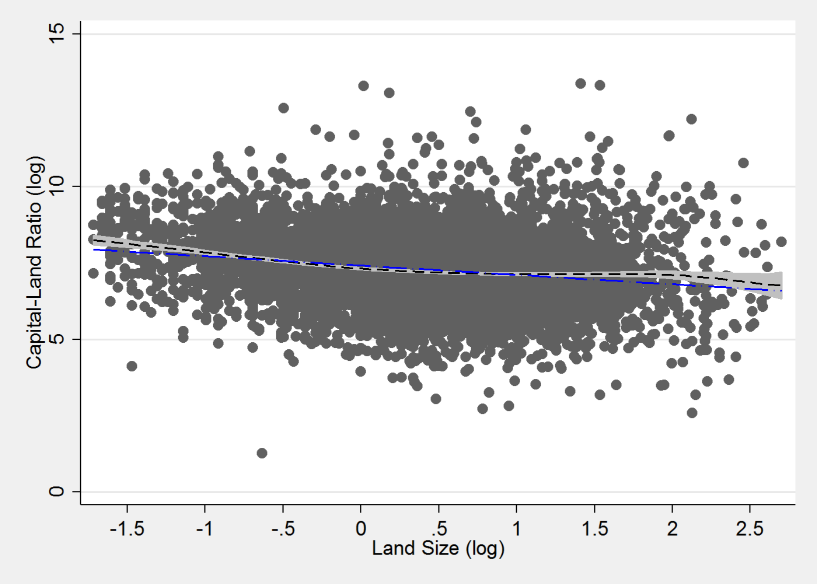
Fact 4.1 Capital vs. Farm Size



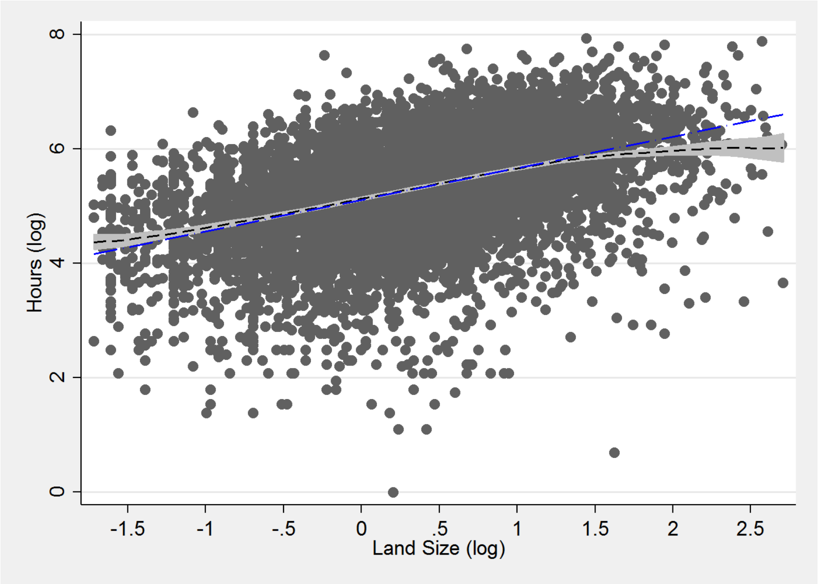
Notes: The correlation is .42 (N .37, C .48, S .35).

Fact 4.2 Capital-Land Ratio vs. Farm Size



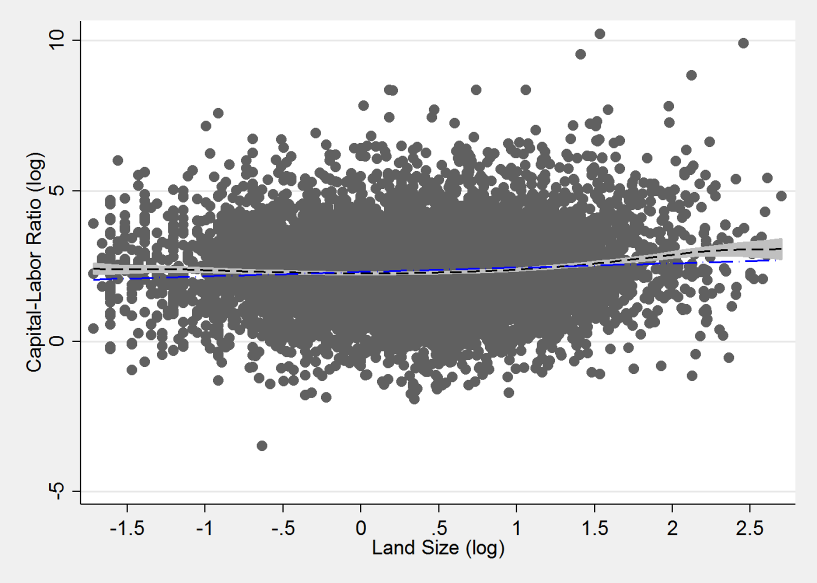
Notes: The correlation is -.20 (N -.31, C -.05, S .-30).

Hours vs. Farm Size



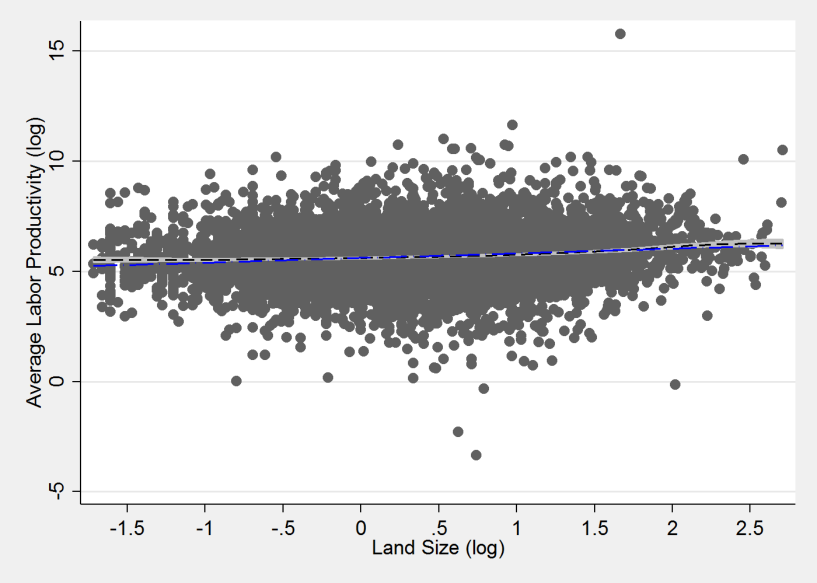
Notes: The correlation is .45 (N .45, C .47, S .41).

Capital-Labor Ratio vs. Farm Size



Notes: The correlation is .07 (N -.03, C .16, S .03).

Labor Productivity vs. Farm Size



Notes: The correlation is .13 (N .03, C .21, S -.01).

Land Quality Dimensions (continued)

- Global Agro-Ecological Zone (GAEZ):

  Use latitude and longitude coordinates. Within Malawi we can identify four zones.

		Regions		
	Full Sample	North	Center	South
Tropic-warm/semiarid	47.49	4.31	63.13	51.90
Tropic-warm/subhumid	35.23	50.47	11.12	47.41
Tropic-cool/semiarid	10.55	10.24	24.17	.68
Tropic-cool/subhumid	6.72	34.98	1.58	.11
	100.00	100.00	100.00	100.00

In rural areas, population distribution across regions is 17.49% in Northern Malawi, 34.89% in Center, and 47.62% in Southern Malawi.

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Land Quality Dimensions (continued)

	Full Sample		Regions					
			North		Center		South	
Slope:								
Flat	56.24	(2.5)	57.07	(3.6)	54.84	(2.4)	56.98	(2.4
Slight	32.54	(4.9)	27.99	(5.8)	34.77	(3.7)	32.45	(5.7
Moderate	8.14	(6.2)	8.68	(8.0)	8.24	(5.4)	7.88	(6.5
Steep/Hilly	3.08	(10.3)	6.26	(14.6)	2.15	(6.7)	2.68	(10.7
	100.00	(3.5)	100.00	(4.9)	100.00	(2.9)	100.00	(3.5
Erosion, q_i^{ero}:								
No Erosion	60.69		51.62		61.82		62.96	
Low	26.66		31.56		25.82		25.60	
Moderate	7.57		10.23		7.65		6.60	
High	5.08		6.59		4.71		4.84	
	100.00		100.00		100.00		100.00	
Soil Quality, q_i^{sq}:								
Good	45.95		48.86		44. 91		45.72	
Fair	42.63		43.47		40.51		43.89	
Poor	11.42		7.67		14.58		10.39	
	100.00		100.00		100.00		100.00	

Notes: Regressing *ln*(*slope*) on self-reported slope dummies we find all dummies significant, and capturing 17% of the slope variation.

Land Quality Dimensions (continued)

	Full Samp.	Regions North	Center	South
Nutritient Availability, q_i^{na}:				
No or Slight Rest.	59.63	28.29	47.05	80.37
Moderate Rest.	22.13	43.13	25.74	11.76
Severe Rest.	13.51	22.24	18.24	6.84
Very Severe Rest.	.42	6.34	1.20	1.03
	100.00	100.00	100.00	100.00
Nutritient Retention Capacity, q_i^{nc}:				
No or Slight Rest.	65.12	43.42	51.81	82.85
Moderate Rest.	28.81	44.24	38.38	16.12
Severe Rest.	1.51	6.00	1.31	.00
Very Severe Rest.	.51	6.34	1.46	.00
	100.00	100.00	100.00	100.00
Rooting Conditions, q_i^{rc}:				
No or Slight Rest.	63.75	38.53	72.36	66.70
Moderate Rest.	15.69	26.19	10.80	15.42
Severe Rest.	14.01	26.78	9.05	12.96
Very Severe Rest.	2.33	2.15	.76	3.55
	100.00	100.00	100.00	100.00

Land Quality Dimensions (continued)

	Full Samp.	North	Regions Center	South
Oxygen Availability to Roots, q_i^{oar}:				
No or Slight Rest.	85.50	84.40	81.67	88.71
Moderate Rest.	6.35	6.11	4.12	8.08
Severe Rest.	3.42	3.14	5.25	2.18
Very Severe Rest.	.67	.00	1.93	.00
	100.00	100.00	100.00	100.00
Excess Salts, q_i^{exs}:				
No or Slight Rest.	91.35	84.40	90.81	94.31
Moderate Rest.	3.50	5.94	.70	4.66
Severe Rest.	.84	3.32	.73	.00
Very Severe Rest.	.25	.00	.73	.00
	100.00	100.00	100.00	100.00
Toxicity, q_i^{tox}:				
No or Slight Rest.	93.08	84.40	90.81	97.93
Moderate Rest.	1.99	7.10	.70	1.05
Severe Rest.	.63	2.15	.73	.00
Very Severe Rest.	.25	.00	.73	.00
	100.00	100.00	100.00	100.00

Land Quality Dimensions (continued)

	Full Samp.	Regions North	Center	South
Workability, q_i^w:				
No or Slight Rest.	48.31	37.25	69.47	36.87
Moderate Rest.	27.83	27.88	13.46	38.34
Severe Rest.	15.67	26.37	9.28	16.42
Very Severe Rest.	3.97	2.15	.76	6 .99
	100.00	100.00	100.00	100.00

Back

Dispersion (Variance) of Land Quality

	Full Samp.	By Geographic Aggregation Level: Regions	Districts	Enum. Area
Land Size, L_i:	.618	.595	.545	.488
Quality-Adjusted Land Size:				
$q_i^0 L_i$	.647	.625	.568	.485
$q_i^1 L_i$	.636	.618	.566	.486
$q_i^2 L_i$	.704	.691	.609	.510
$q_i^3 L_i$	.942	.927	.736	.514

Notes: All variables have been logged.

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Rain Shocks, ζ_i

- Annual Precipitation (total rainfall, mm) (last 12 months), and average 12-month total rainfall (mm) in last 10 years (since 2001).

  To compute the unanticipated amount of rain in 2010/11, u_{2010}, we remove from the current annual precipitation the average of total rainfall of the past 10 years,

  $$\ln \textit{total rainfall}_{2010} = \textit{cons} + \beta \ln \textit{average total rainfall}_{since2001} + u_{2010} \quad (2)$$

- Precipitation of wettest quarter (mm) (within last 12 months), and average precipitation of wettest quarter (mm) in last 10 years (since 2001).[1]

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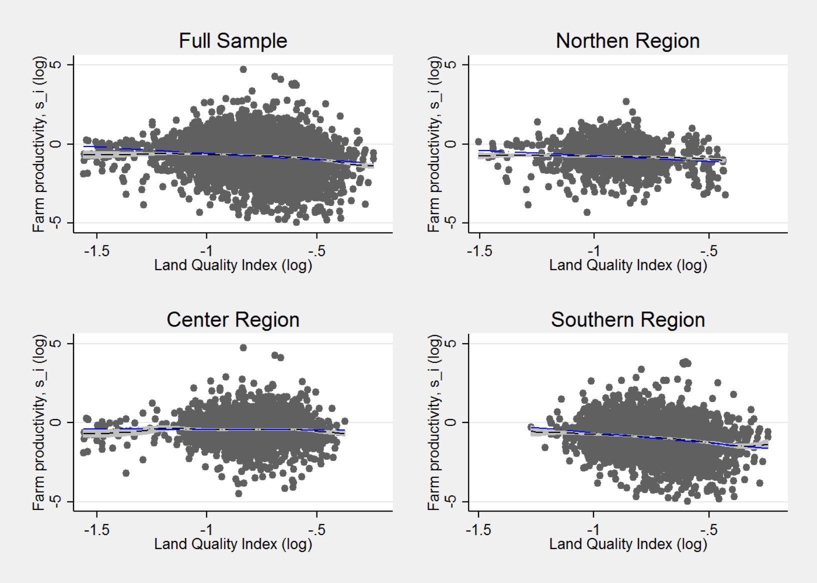
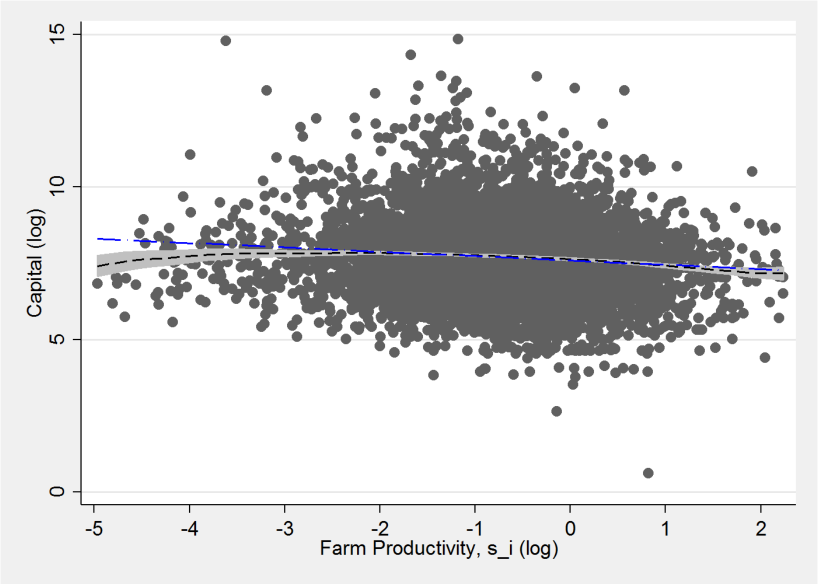
[1] For now, we ignore temperature and greenness.

Productivity s_i vs. Land Quality Index q_i: By Region



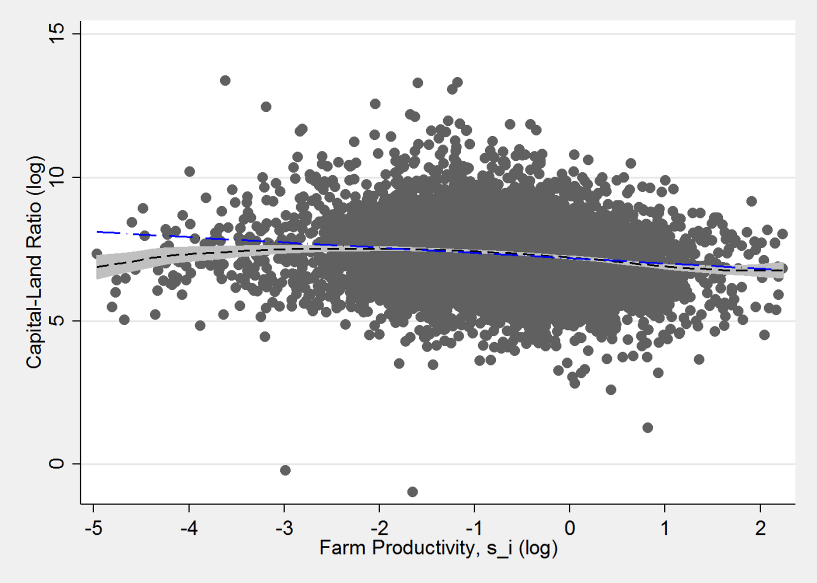
Notes: The correlations b/w land quality and s_i is -.14 in the full sample, -.13 in the Northern region, -.01 in the Center region, and -.21 in the Southern region.

Capital vs. Farm Productivity



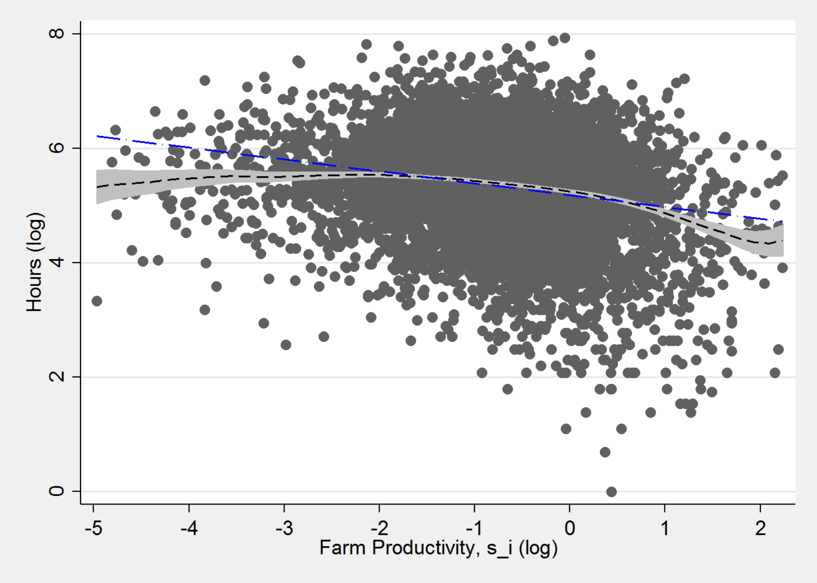
Notes: The correlation is -.10 (N -.16, C -.15, S -.14).

Capital-Land Ratio vs. Farm Productivity



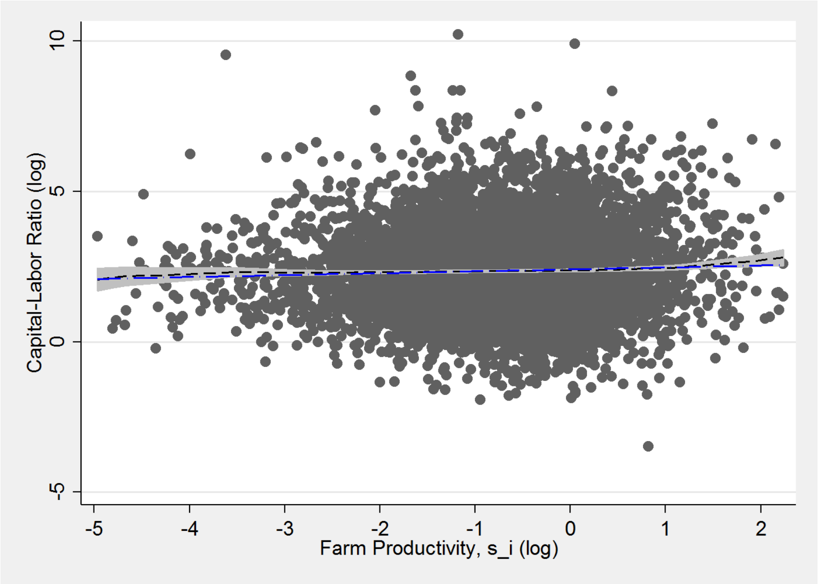
Notes: The correlation is -.14 (N -.18, C -.22, S -.09).

Hours vs. Farm Productivity



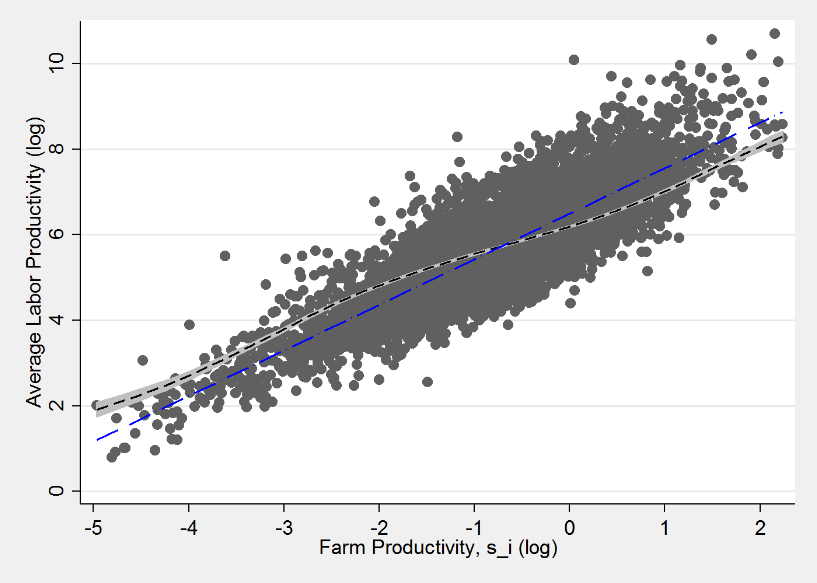
Notes: The correlation is -.21 (N -.32, C -.23, S -.25).

Capital-Labor Ratio vs. Farm Productivity



Notes: The correlation is .04 (N .11, C -.00, S .04).

Labor Productivity vs. Farm Productivity



Notes: The correlation is . 84 (N .85, C .80, S .87).

Variance Decomposition y_i

	ζ_i q_i		ζ_i q_i		ζ_i q_i		ζ_i q_i	
	Y Y	%	N N	%	Y N	%	N Y	%
$var(y)$	1.423	100.0	1.423	100.0	1.423	100.0	1.423	100.0
$var(s)$	.968	68.0	.937	65.8	.943	66.3	.962	67.6
$var(\zeta)$	.007	.5	–	–	.007	.5	–	–
$var(f(k,ql))$	.297	20.9	.303	21.3	.303	21.3	.297	20.9
$2cov(s,\zeta)$	-.012	-.8	–	–	-.012	-.8	–	–
$2cov(s,f(k,ql))$	.156	11.0	.172	12.1	.170	11.9	.158	11.1
$2cov(s,\theta_k k)$	*.082*	*5.8*	*.084*	*5.9*	*.082*	*5.8*	*.086*	*6.0*
$2cov(s,\theta_l q)$	*-.012*	*-.8*	–	–	–	–	*-.014*	*-1.0*
$2cov(s,\theta_l l)$	*.086*	*6.0*	*.088*	*6.2*	*.088*	*6.2*	*.086*	*6.0*
$2cov(\zeta,f(k,ql))$	.003	–	–	.3	.004	.3	–	–
$2cov(\zeta,\theta_k k)$	*.003*	*.2*	–	–	*.003*	*.3*	–	–
$2cov(\zeta,\theta_l q)$	*-.000*	*-.0*	–	–	–	–	–	–
$2cov(\zeta,\theta_l l)$	*.000*	*.0*	–	–	*.000*	*.0*	–	–

Notes: All variables have been logged.

Variance Decomposition y_i, by region (with q_i and ζ_i)

			Regions					
	Full S.	%	North	%	Center	%	South	%
$var(y)$	1.423	100.0	1.252	100.0	1.156	100.0	1.432	100.0
$var(s)$	.968	68.0	.735	58.7	.726	62.8	1.054	73.6
$var(\zeta)$	.007	.5	.004	.3	.012	1.0	.004	.3
$var(f(k,ql))$	.297	20.9	.292	23.3	.324	28.0	.263	18.4
$2cov(s,\zeta)$	-.012	-.8	-.006	-.5	-.024	-2.1	.001	.1
$2cov(s,f(k,ql))$	.156	11.0	.204	16.3	.116	10.0	.103	7.2
$2cov(\zeta,f(k,ql))$	.003	.2	-.001	-.1	.004	.3	.000	.0

Notes: All variables have been logged.

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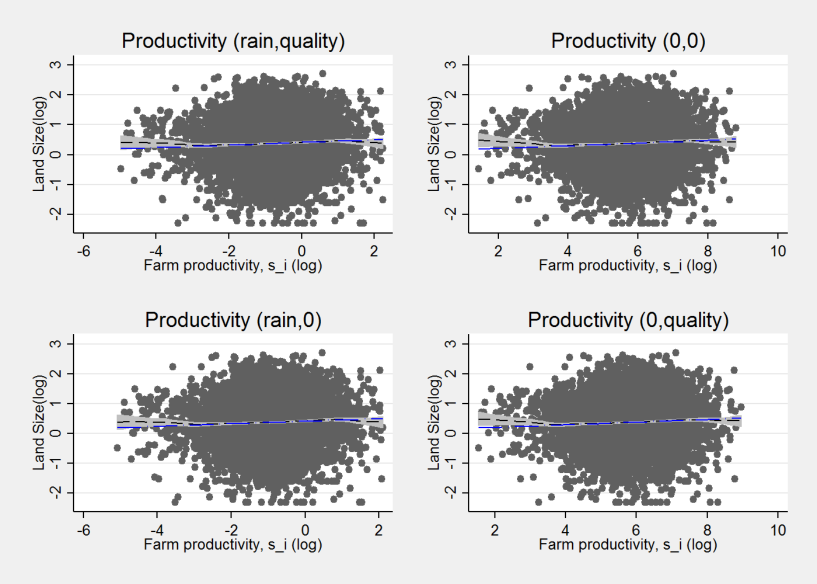
Productivity s_i vs. Land Size



Notes: The correlations b/w land size and $s(\zeta_i, q_i)$ is .05, $s(0,0)$ is .01, $s(\zeta_i, 0)$ is .09, and $s(0, q_i)$ is -.06.

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Inequality

	Productivity	Data Land	Capital	Output	Efficient $\{l_i, k_i, y_i\}$
Variance	.909	.841	1.715	1.161	4.297
75-25	3.61	2.78	4.95	4.22	12.20
90-10	10.82	7.67	24.21	19.96	177.12
Gini	.51	.50	.72	.63	.94

Notes: To compute the variance, variables are in logs. Ouptut is net of quality and rain shocks.

Inequality By Region

Northern Region :		Data			Efficient
	Productivity	Land	Capital	Output	$\{l_i, k_i, y_i\}$
Variance	.688	.821	1.619	1.191	3.253
75-25	2.83	3.21	5.08	4.14	9.65
90-10	7.82	9.27	24.11	15.46	87.46

Center Region :		Data			Efficient
	Productivity	Land	Capital	Output	$\{l_i, k_i, y_i\}$
Variance	.700	.672	1.886	1.136	3.310
75-25	2.67	2.79	5.26	3.57	8.48
90-10	7.14	7.32	29.68	12.86	71.83

Southern Region :		Data			Efficient
	Productivity	Land	Capital	Output	$\{l_i, k_i, y_i\}$
Variance	1.024	.687	1.469	1.398	4.843
75-25	3.36	2.70	4.51	4.39	13.95
90-10	17.91	7.44	19.45	28.18	529.90

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