

Annex 2: Regression results in Chapter 5

TABLE A2.1: DETERMINANTS OF AGRICULTURAL PRODUCTIVITY: BASIC MODEL

Dependent variable: log output value per hectare	OLS regression	IV regression
Owned with title	0.035 (1.14)	0.730 (3.22)**
Log of farm size	-0.693 (28.93)**	-0.699 (28.70)**
Log of hh labour	0.152 (6.25)**	0.136 (5.48)**
Log of spending on other inputs	0.457 (21.91)**	0.450 (21.48)**
Irrigated	0.099 (2.88)**	0.109 (3.05)**
<i>Type of land:</i>		
Dry season land	0.09 (1.74)	0.105 (1.98)*
Both wet and dry season land	0.366 (4.15)**	0.349 (3.88)**
Chamkar land	0.179 (2.88)**	0.197 (3.18)**
Vegetable garden	1.036 (5.72)**	1.085 (5.72)**
Other types of land	0.155 (1.10)	0.158 (1.13)
Years of schooling of head	0.007 (2.22)*	0.007 (2.33)*
Dependency ratio	0.023 (1.80)	-0.046 (3.96)**
Constant	0.618 (2.40)*	0.740 (2.74)**
Village fixed effects	Yes	Yes
Observations	14892	14892
R-squared	0.51	
Chi-sq overidentification test		7.45 (0.114)

Note: Robust, absolute t statistics in parentheses. The omitted category for type of land is wet season land. * significant at 5 percent; ** significant at 1 percent. Property rights variables are instrumented by dummies for mode of acquisition (i.e., purchase, gift, inheritance, own clearing of land, marriage, occupation for free, and donation by friends).

TABLE A2.2: DETERMINANTS OF AGRICULTURAL PRODUCTIVITY: ALTERNATIVE MODEL SPECIFICATIONS

	<i>Dependent variable: Log of value of production per hectare</i>			
	<u>All plots operated</u>		<u>Plots owned and operated</u>	
	OLS	IV	OLS	IV
Owned with title	0.008 (0.30)	0.634 (3.68)**	0.006 (0.23)	0.621 (3.60)**
Log of farm size	-0.721 (31.85)**	-0.723 (30.21)**	-0.717 (30.70)**	-0.719 (29.10)**
Log of hh labour	0.154 (5.80)**	0.138 (4.83)**	0.157 (5.79)**	0.141 (4.87)**
Log of spending on other inputs	0.497 (25.49)**	0.491 (23.24)**	0.494 (24.64)**	0.486 (22.28)**
Years of schooling of head	0.004 (1.47)	0.004 (1.35)	0.005 (1.70)	0.005 (1.61)
Dependency ratio	0.042 (2.96)**	0.042 (2.77)**	0.045 (3.13)**	0.045 (2.92)**
Irrigated	0.12 (3.97)**	0.132 (3.96)**	0.116 (3.76)**	0.129 (3.81)**
<i>Type of land:</i>				
Dry season land	0.187 (4.18)**	0.208 (4.34)**	0.196 (4.29)**	0.216 (4.39)**
Both wet and dry season land	0.306 (3.57)**	0.184 (2.19)*	0.323 (3.25)**	0.202 (2.18)*
Chamkar land	0.377 (6.89)**	0.385 (6.86)**	0.353 (6.34)**	0.36 (6.34)**
Vegetable garden	1.175 (6.68)**	1.188 (6.30)**	1.196 (6.67)**	1.208 (6.27)**
Other types of land	0.274 (2.45)*	0.283 (2.51)*	0.241 (2.15)*	0.254 (2.24)*
<i>Village infrastructure</i>				
Permanent market in village	0.203 (3.19)**	0.211 (2.98)**	0.197 (3.14)**	0.205 (2.96)**
Dist. from village to all-weather road (km.)	-0.006 (2.72)**	-0.005 (1.99)*	-0.006 (2.89)**	-0.005 (2.13)*
Constant	0.074 (0.31)	0.039 (0.14)	0.105 (0.43)	0.073 (0.26)
Fixed effects	Province	Province	Province	Province
Observations	15,457	15,457	14,813	14,813
R-squared	0.43		0.42	

Note: Robust t statistics in parentheses. * significant at 5 percent; ** significant at 1 percent. In the IV-regressions, "owned with title" is instrumented with mode of acquisition dummies. Only rural areas are included.

TABLE A2.3: PROPERTY RIGHTS AND PRODUCTIVITY, ROBUSTNESS CHECKS

	Measure of property rights		Observations
	Any paper	Title	
Farm level	0.279 (3.29)**	0.624 (3.28)**	8.740
Rice plots only	0.337 (3.66)**	0.782 (3.69)**	12.066
Non-rice plots only	0.314 (1.13)	0.695 (0.96)	2.462
Draft animals included	0.391 (3.30)**	0.792 (2.99)**	11.135
Households using hired labour	0.338 (3.18)**	0.684 (2.98)**	10.927
Households not using hired labour	0.338 (1.52)	0.734 (1.54)	4.141

Note: Robust, absolute t statistics in parentheses. * significant at 5 percent; ** significant at 1 percent.

The result suggests that the (IV regression) coefficients on property rights variables are robust to different specifications of the model in Table A2.2. The dependent variable is in all cases log of the value of output per hectare. The property rights variables are in all cases instrumented with different modes of land acquisition (i.e., purchase, gift, inheritance, own clearing of land, marriage, occupation for free, and donation by friends).

TABLE A2.4: Farmsize and productivity

	Dependent variable: Log of value of output per hectare					
	Households without hired labor			Households with hired labor		
Log of farmsize	-0.553 (17.00)**	-0.552 (16.65)**	-0.700 (21.28)**	-0.453 (16.13)**	-0.456 (16.31)**	-0.677 (20.02)**
Log of household size			0.195 (3.77)**			0.119 (4.27)**
Log of capital input			0.379 (8.95)**			0.349 (14.92)**
Log of spending on hired labor						0.134 (9.38)**
Irrigated		0.14 (2.30)*	0.12 (1.85)		0.177 (4.25)**	0.134 (3.19)**
<i>Crop grown last season:</i>						
Other crops than rice (including vegetable)		0.304 (2.41)*	0.321 (2.57)*		0.33 (4.37)**	0.309 (4.02)**
Rice and other crops		0.001 (0.01)	-0.027 (0.2)		0.189 (2.04)*	0.148 -1.65
Perennial trees		0.297 (2.07)*	0.357 (2.51)*		0.132 -1.29	0.176 -1.71
None^^		0.178 -0.29	0.662 -1.08		0.526 -1.83	0.581 (2.15)*
Years of schooling of head			0.006 -1.02			0.004 -1.21
Dependency ratio			-0.072 (2.82)**			-0.037 (2.60)**
Village fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4432	4432	4222	11295	11295	11040
R-squared	0.48	0.49	0.54	0.43	0.43	0.5

Note: Robust t statistics in parentheses. * significant at 5%; ** significant at 1%

^^The yield data refer to the last 12 months. Therefore some plots have registered output even if a crop was not grown in the last season (plots with no output at all in the last 12 months are excluded). The reference category for crops grown last season is rice. Hired labor includes expenses for hired draft power. "Irrigated" is a dummy for whether the plot is irrigated during either wet or dry season, or both..

TABLE A2.5: Determinants of land values (IV estimates) --- plot level

	Dependent variable (all in US \$/ac)			
	Land rental price		Land sales price	
Land title (instrumented)	0.587*** (5.26)	0.571*** (4.45)	1.039*** (9.80)	0.381*** (3.32)
Land area (log)	-0.505*** (48.27)	-0.522*** (53.71)	-0.549*** (56.50)	-0.521*** (61.92)
Log land area squared	0.026*** (7.99)	0.025*** (8.89)	-0.017*** (5.72)	-0.011*** (4.69)
Land planted with trees	0.665*** (19.20)	0.559*** (17.66)	0.598*** (18.85)	0.581*** (21.34)
Irrigated in dry season	0.258*** (8.93)	0.148*** (5.46)	0.258*** (9.46)	0.104*** (4.35)
Irrigated in wet season	0.134*** (6.82)	0.080*** (4.08)	0.158*** (8.53)	0.132*** (7.58)
Chamkar (cash crop) land	0.396*** (16.16)	0.304*** (12.83)	0.011 (0.49)	-0.015 (0.74)
Vegetable land	0.171*** (2.88)	0.231*** (4.31)	0.289*** (5.08)	0.214*** (4.48)
Dry season land	0.180*** (5.43)	0.172*** (5.05)	0.061* (1.96)	-0.112*** (3.74)
Type of dummy included	Province	Village	Province	Village
Observations	19,170	19,170	19,654	19,654
R-squared	0.38	0.61	0.32	0.62

Identifying instruments are the presence of an application receipt, dummies for different types of land acquisition, and household characteristics. Absolute value of t statistics in parentheses. * significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent.

TABLE A2.6: Welfare impact of land ownership and title (IV regressions)

	Dependent variable:	
	Per capita expenditure	
Land title (instrumented)	0.362*** (5.22)	0.244*** (3.06)
Head's education (log)	0.055*** (8.80)	0.044*** (7.72)
Head's education (log) squared	0.006*** (7.55)	0.005*** (6.90)
Value of non-land assets (log)	0.153*** (56.28)	0.128*** (48.36)
Female head	-0.000** (2.41)	-0.000*** (3.93)
Share of members in wage employment	0.424*** (9.38)	0.298*** (7.10)
Share of members w. self employment	0.060** (2.45)	-0.028 (1.19)
Landless dummy	0.177*** (5.54)	-0.001 (0.03)
Landless * rural dummy	-0.109*** (4.67)	-0.007 (0.25)
No. of household members	-0.645*** (50.36)	-0.617*** (51.51)
Rural dummy	-0.157*** (8.60)	-0.890*** (4.76)
Type of dummy included	Province	Village
Observations	14978	14978
R-squared	0.53	0.66

Note: Identifying instruments are the presence of an application receipt, dummies for different types of land acquisition, and household characteristics. Absolute value of t statistics in parentheses: * significant at 5 percent; ** significant at 1 percent. Not shown in the Table are log of land area and its higher orders; household head age and higher orders.

Explanatory Note about Instrumental Variable (IV) Regressions:

Land title is one of the explanatory variables in the regressions but it is an endogenous variable, and therefore, one needs to use the Instrumental Variable (IV) Approach. What we mean by “an endogenous variable” is that for example, the quality of soil can affect both the productivity (and value) of the plot and the likelihood of having a title. Owners with more fertile land will have greater incentives to acquire title for his land. Since we do not have a good variable to control for quality of soil in an OLS regression, we will purge this endogenous effect of quality of soil by using an IV to identify exogenous variation in land titling. The IV chosen in our case is the mode of acquisition of land --- purchase, inheritance, marriage, own-clearance, donation, or government provision. Why is the mode of acquisition a good IV? First, how the plot of land was acquired surely affects the plot’s likelihood of having a title. For example, a purchased plot has a higher probability to come with a title compared to a forest plot cleared by the owner. Second, the mode of acquisition does not and should not affect land productivity (and value). Through the use of IVs, the coefficients on the variable of “land title” estimate the impacts of land title on productivity and land value, purged of the endogenous effects of soil quality. In contrast, OLS coefficients are biased by such endogenous effects from uncontrolled soil quality.