THE POLITICAL ECONOMY OF THE LAND TENURE: THEORY AND EVIDENCE FROM COLOMBIA.

JUAN CARLOS MUÑOZ-MORA

Abstract. This propose explores the different mechanism of rent-seeking thou, using a unique panel data set for Colombian municipalities.
Keywords:

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Tables and Figures

Table 1. Overall mean by year for time-varying variables

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Proportion of coca fields per 1000 hectares	0.937	0.640	0.312	0.302	0.314	0.310	0.318	0.421	0.324	0.388
	[9.205]	[5.782]	[1.739]	[1.357]	[1.423]	[1.438]	[1.615]	[2.044]	[1.466]	[1.721]
Land tenure formality index	0.794	0.795	0.800	0.804	0.812	0.812	0.818	0.822	0.827	0.833
	[0.221]	[0.220]	[0.214]	[0.211]	[0.206]	[0.206]	[0.202]	[0.196]	[0.192]	[0.184]
Homicide rate per 100000 inhabitants	56.994	61.544	65.687	59.940	51.315	40.653	40.991	40.785	34.545	29.423
	[78.166]	[75.834]	[77.857]	[83.567]	[67.680]	[52.456]	[50.540]	[47.243]	[41.698]	[33.766]
Public expenditures per capita in education	51.404	51.574	58.746	45.978	39.059	44.723	39.371	57.229	63.765	222.992
	[39.980]	[43.362]	[52.011]	[43.492]	[72.963]	[60.066]	[59.429]	[82.744]	[79.362]	[3012.677]
Public expenditures per capita in justice	0.238	0.285	1.275	16.829	13.291	3.952	4.135	6.732	8.011	32.650
	[1.250]	[0.861]	[3.100]	[48.347]	[20.848]	[11.012]	[9.504]	[17.332]	[14.679]	[537.091]
Number of agricultural loans per 1000 inhabitants	2.367	2.038	3.282	5.059	8.383	11.725	13.525	13.167	12.042	13.564
	[3.847]	[3.449]	[4.506]	[6.344]	[10.366]	[13.983]	[16.127]	[15.802]	[14.367]	[15.419]
Land quality gini index	0.687	0.687	0.688	0.687	0.689	0.689	0.690	0.692	0.692	0.692
	[0.116]	[0.113]	[0.112]	[0.112]	[0.110]	[0.110]	[0.110]	[0.107]	[0.106]	[0.103]
Number of hectares per landowner	4.679	4.789	4.712	4.676	4.620	4.577	4.545	4.516	4.552	4.496
	[13.597]	[13.843]	[13.601]	[13.409]	[13.226]	[13.067]	[13.011]	[12.808]	[12.870]	[12.562]
Health coverage (SISBEN)	89.102	89.102	89.102	89.102	89.102	89.102	88.781	89.102	89.423	89.102
	[92.068]	[92.068]	[92.068]	[92.068]	[92.068]	[92.068]	[182.821]	[92.068]	[11.460]	[92.068]
Avearge over years of schooling	4.258	4.258	4.258	4.258	4.258	4.258	4.258	4.258	4.258	4.258
	[0.900]	[0.900]	[0.900]	[0.900]	[0.900]	[0.900]	[0.900]	[0.900]	[0.900]	[0.900]
Observations	877	877	877	877	877	877	877	877	877	877

Notes - Standard errors in brackets. We present the mean over all municipalities each year. Data source: CEDE, 2012.

Table 2. Mean test for the time-variant variable by presence of coca

	Municipalities that ever had coca crops	Municipalities that never had coca crops	Difference
Land tenure formality index	0.667	0.855	-0.187***
	[-38.824]	[0.000]	[0.00483]
	2010	6760	
Homicide rate per 100000 inhabitants	65.043	43.176	21.867***
	[13.536]	[0.000]	[1.615]
	2010	6760	
Public expenditures per capita in education	51.382	72.272	-20.889
	[-0.861]	[0.389]	[24.27]
	2010	6760	
Public expenditures per capita in justice	5.338	9.751	-4.414
	[-1.016]	[0.310]	[4.346]
	2010	6760	
Number of agricultural loans per 1000 inhabitants	5.807	9.320	-3.513***
	[-11.160]	[0.000]	[0.315]
	2010	6760	
Land quality gini index	0.646	0.702	-0.057***
	[-20.728]	[0.000]	[0.00273]
	2010	6760	
Number of hectares per landowner	8.693	3.404	5.289***
	[15.999]	[0.000]	[0.331]
	2010	6760	
Health coverage (SISBEN)	88.893	89.164	-0.271
	[-0.106]	[0.916]	[2.557]
	2010	6760	
Avearge over years of schooling	3.753	4.408	-0.655***
	[0.852]	[0.859]	[0.0218]
	2010	6760	

Notes - Standard errors in brackets. Number of observation in the third row. * Significant at 10%, ** significant at 5%, and *** significant at 1%. Two-side mean test significance reported. We define presence of coca if a given municipality had at least one year coca. Data source: CEDE, 2012.

TABLE 3. Summary statistics for time-variant variables

		Mean	St. Deviation	Min	Max	Observation
Proportion of coca fields per 1000 hectares	overall	0.427	3.732	0	196.4	8770
	between	.	2.424	0	44.90	877
	within	.	2.839	-39.10	151.9	10
Land tenure formality index	overall	0.812	0.206	0	1	8770
	between	.	0.201	0.0816	1	877
	within	.	0.0446	0.0759	1.637	10
Municipal development index	overall	43.98	15.34	4.188	92.29	8770
	between	.	9.266	13.18	76.31	877
	within	.	12.22	16.38	79.45	10
Homicide rate per 100000 inhabitants	overall	48.19	64.24	0	1232.2	8770
	between	.	42.08	0	352.2	877
	within	.	48.56	-258.8	1070.4	10
Public expenditures per capita in education	overall	67.48	955.4	0	78221.0	8770
	between	.	304.2	10.82	7859.4	877
	within	.	905.7	-7775.3	70429.1	10
Public expenditures per capita in justice	overall	8.740	171.1	0	15572.8	8770
	between	.	54.14	0.244	1560.4	877
	within	.	162.3	-1551.6	14021.2	10
Number of agricultural loans per 1000 inhabitants	overall	8.515	12.48	0	91.35	8770
	between	.	9.478	0	53.45	877
	within	.	8.121	-41.43	65.81	10
Land quality gini index	overall	0.689	0.110	0	0.981	8770
	between	.	0.107	0.0493	0.977	877
	within	.	0.0241	0.0947	1.181	10
Number of hectares per landowner	overall	4.616	13.20	0.0500	178.9	8770
	between	.	13.10	0.107	162.3	877
	within	.	1.653	-40.08	40.84	10
Health coverage (SISBEN)	overall	89.10	100.6	33.66	5261.0	8770
	between	.	92.07	48.60	2679.1	877
	within	.	40.73	-2492.8	2671.0	10
Avearge over years of schooling	overall	4.258	0.900	0.750	7.720	8770
	between	.	0.900	0.750	7.720	877
	within	.	0	4.258	4.258	10

Notes - The table reports between and within variations for all time-varying variables. The within transformation demeans the data by subtracting the mean for each municipality and then adding up the overall mean. This explains the negative minimums for positive variables. The *overall observations* are the total number of observations, *between observations* is the number of observations per time period and *within observations* is the number of time periods in which there is data available for each variable.. Data source: CEDE, 2012.

TABLE 4. Transition probability and descriptive statistics for the presence of coca

	Transition Probability (%)		Panel Data Tabulation (%)		
	Non-coca	Coca	Overall	Between	Within
Non-coca	97.73	2.272	85.7	91.0	94.2
			[7515]	[798]	
Coca	13.18	86.82	14.3	22.9	62.4
			[1255]	[201]	

Notes - Number of observation in brackets. The transition probability describes changes in categorical variable over time. Panel Data Tabulation is constructed by performing one-way tabulations and decomposing counts into within and between components. .Data source: CEDE, 2012.

TABLE 5. Summary statistics for time-invariant variables

	Mean	Std. Deviation	Min	Max
Meters above sea level	1223.371	1215.980	2	25221.000
Distance to the nearest market (km)	77.510	53.557	0	360.770
Distance to the nearest market (km)	119.800	79.390	0	561.533
Suitability of land for farming	2.745	1.210	0	8.000
Soil erosion	1.948	1.021	0	5.000
Observations	877			

Notes - We consider all the municipalities used in the baseline results. Antioquia is excluded. In the panel context, the values are assumed constant across years. Data source: CEDE, 2012.

Table 6. Baseline results

Dependent variable: Proportion of coca fields per 1000 hectares

	Pooled OLS	OLS FE	System GMM						
						Violence as exogenous	Violence as endogenous		
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
L.Proportion of coca fields per 1000 hectares	0.538***	0.453***	0.288***	0.285***	0.281***	0.287***	0.292***	0.291***	0.285***
	[0.056]	[0.006]	[0.031]	[0.031]	[0.031]	[0.030]	[0.026]	[0.025]	[0.026]
Land tenure formality index	-1.055***	0.441	-1.484***	-1.440***	-1.120***	-1.481***	-1.320***	-1.280***	-1.017***
	[0.149]	[0.269]	[0.283]	[0.285]	[0.239]	[0.279]	[0.268]	[0.271]	[0.221]
Homicide rate per 100000 inhabitants						0.001***	0.003	0.003	0.003
						[0.000]	[0.003]	[0.004]	[0.003]
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-Variant Controls	No	No	No	Yes	Yes	No	No	Yes	Yes
Time-Invariant Controls	No	No	No	No	Yes	No	No	No	Yes
No. of observations	7893	7893	7893	7893	7893	7893	7893	7893	7893
No. of groups		877	877	877	877	877	877	877	877
No. of instruments			17	23	28	18	24	30	35
p-value F test of joint significance			0.000	0.000	0.000	0.000	0.000	0.000	0.000
p-value Arellano-Bond test for AR(1) in first differences			0.015	0.016	0.016	0.015	0.016	0.016	0.016
p-value Arellano-Bond test for AR(2) in first differences			0.249	0.249	0.250	0.254	0.266	0.264	0.264
p-value Hansen J test of overidentifying restrictions			0.398	0.400	0.408	0.426	0.631	0.630	0.606
p-value Difference-in-Hansen test of exogeneity for instrument subsets (unrestricted)			0.285	0.287	0.293	0.310	0.549	0.534	0.498
p-value Difference-in-Hansen test of exogeneity for instrument subsets (difference)			0.930	0.921	0.991	0.926	0.603	0.649	0.686

Notes - * Significant at 10%, ** significant at 5%, and *** significant at 1%. * Significant at 10%, ** significant at 5%, and *** significant at 1%. Base sample is a balanced panel from 2000 to 2009. The dependent variable is the Proportion of Coca Field per 1000 hectares per municipality. Two step System GMM is implemented. We use the forward orthogonal deviations proposed by ? (?). The ? (?) finite sample correction for standard errors is employed. We use two lags instruments in the collapsed instrument matrix.The time-variant controls include: Land quality gini index, Number of hectares per landowner, health coverage (SISBEN), Public expenditure per capita in education, Public expenditure per capita in justice per capita and Agrarian loan. The time-invariant controls include: Altitude, Distance to the National Capital (Bogota), Distance to the main regional market, Land aptitude index and Land Erosion index. The Hansen J-test reports the p-values for the null hypothesis of instrument validity. The values reported for the Diff-in-Hansen test are the p-values for the validity of the additional moment restriction necessary for system GMM. The values reported for AR(1) and AR(2) are the p-values for first and second order autocorrelated disturbances in the first differences equations.

TABLE 7. Unbalanced panel using only updated cadastral information

Dependent variable: Proportion of coca fields per 1000 hectares

	Pooled OLS	OLS FE	System GMM						
			Violence as exogenous				Violence as endogenous		
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
L.Proportion of coca fields per 1000 hectares	0.738***	0.181***	0.244*	0.248*	0.279**	0.223*	0.150	0.151	0.190
	[0.074]	[0.068]	[0.138]	[0.136]	[0.131]	[0.131]	[0.136]	[0.139]	[0.128]
Land tenure formality index	-1.222***	1.313	-1.946***	-2.125***	-1.745***	-1.942***	-2.140***	-2.361***	-1.825***
	[0.295]	[1.532]	[0.495]	[0.523]	[0.463]	[0.505]	[0.579]	[0.693]	[0.607]
Homicide rate per 100000 inhabitants						0.003*	0.010**	0.011**	0.010**
						[0.001]	[0.005]	[0.005]	[0.005]
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-Variant Controls	No	No	No	Yes	Yes	No	No	Yes	Yes
Time-Invariant Controls	No	No	No	No	Yes	No	No	No	Yes
No. of observations	1991	1991	1991	1991	1991	1991	1991	1991	1991
No. of groups		479	479	479	479	479	479	479	479
No. of instruments			17	23	28	18	24	30	35
p-value F test of joint significance			0.000	0.000	0.000	0.000	0.000	0.000	0.000
p-value Arellano-Bond test for AR(1) in first differences			0.066	0.063	0.055	0.062	0.050	0.043	0.039
p-value Arellano-Bond test for AR(2) in first differences			0.428	0.426	0.373	0.509	0.986	0.983	0.806
p-value Hansen J test of overidentifying restrictions			0.234	0.243	0.241	0.234	0.720	0.686	0.696
p-value Difference-in-Hansen test of exogeneity for instrument subsets (unrestricted)			0.159	0.164	0.160	0.178	0.621	0.620	0.613
p-value Difference-in-Hansen test of exogeneity for instrument subsets (difference)			0.737	0.771	0.847	0.509	0.699	0.575	0.634

Notes - * Significant at 10%, ** significant at 5%, and *** significant at 1%. * Significant at 10%, ** significant at 5%, and *** significant at 1%. Base sample is an unbalanced panel from 2000 to 2009. We only use those municipalities that had cadastral updating. The dependent variable is the Proportion of Coca Field per 1000 hectares per municipality. Two step System GMM is implemented. We use the forward orthogonal deviations proposed by ? (?). The ? (?) finite sample correction for standard errors is employed. We use two lags instruments in the collapsed instrument matrix. The time-variant controls include: Land quality gini index, Number of hectares per landowner, health coverage (SISBEN), Public expenditure per capita in education, Public expenditure per capita in justice per capita and Agrarian loan. The time-invariant controls include: Altitude, Distance to the National Capital (Bogota), Distance to the main regional market, Land aptitude index and Land Erosion index. The Hansen J-test reports the p-values for the null hypothesis of instrument validity. The values reported for the Diff-in-Hansen test are the p-values for the validity of the additional moment restriction necessary for system GMM. The values reported for AR(1) and AR(2) are the p-values for first and second order autocorrelated disturbances in the first differences equations.

Table 8. Results including Antioquia (2006-2009)

Dependent variable: Proportion of coca fields per 1000 hectares

	Pooled OLS	OLS FE	System GMM						
						Violence as exogenous	Violence as endogenous		
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
L.Proportion of coca fields per 1000 hectares	0.820***	-0.228***	-0.089	-0.089	-0.074	-0.099	0.016	0.032	0.030
	[0.060]	[0.062]	[0.276]	[0.276]	[0.256]	[0.275]	[0.336]	[0.346]	[0.354]
Land tenure formality index	-0.894***	0.037	-3.943***	-3.845***	-3.225***	-3.791***	-5.573	-5.301	-5.267
	[0.186]	[0.879]	[1.320]	[1.303]	[1.051]	[1.257]	[4.234]	[3.931]	[5.240]
Homicide rate per 100000 inhabitants						0.007**	-0.080	-0.085	-0.098
						[0.003]	[0.164]	[0.175]	[0.219]
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-Variant Controls	No	No	No	Yes	Yes	No	No	Yes	Yes
Time-Invariant Controls	No	No	No	No	Yes	No	No	No	Yes
No. of observations	2997	2997	2997	2997	2997	2997	2997	2997	2997
No. of groups		999	999	999	999	999	999	999	999
No. of instruments			5	11	16	6	6	12	17
p-value F test of joint significance			0.000	0.000	0.000	0.000	0.009	0.110	0.489
p-value Arellano-Bond test for AR(1) in first differences			0.778	0.774	0.718	0.672	0.596	0.599	0.631
p-value Arellano-Bond test for AR(2) in first differences			.	.	.	.	.	.	.
p-value Hansen J test of overidentifying restrictions			.	.	.	.	.	.	.
p-value Difference-in-Hansen test of exogeneity for instrument subsets (unrestricted)			.	.	.	.	.	.	.
p-value Difference-in-Hansen test of exogeneity for instrument subsets (difference)			.	.	.	.	.	.	.

Notes - * Significant at 10%, ** significant at 5%, and *** significant at 1%. * Significant at 10%, ** significant at 5%, and *** significant at 1%. Base sample is an unbalanced panel from 2006 to 2009. The dependent variable is the Proportion of Coca Field per 1000 hectares per municipality. Two step System GMM is implemented. We use the forward orthogonal deviations proposed by ? (?). The ? (?) finite sample correction for standard errors is employed. We use two lags instruments in the collapsed instrument matrix. The time-variant controls include: Land quality gini index, Number of hectares per landowner, health coverage (SISBEN), Public expenditure per capita in education, Public expenditure per capita in justice per capita and Agrarian loan. The time-invariant controls include: Altitude, Distance to the National Capital (Bogota), Distance to the main regional market, Land aptitude index and Land Erosion index. The Hansen J-test reports the p-values for the null hypothesis of instrument validity. The values reported for the Diff-in-Hansen test are the p-values for the validity of the additional moment restriction necessary for system GMM. The values reported for AR(1) and AR(2) are the p-values for first and second order autocorrelated disturbances in the first differences equations.

Table 9. Robustness check for different samples

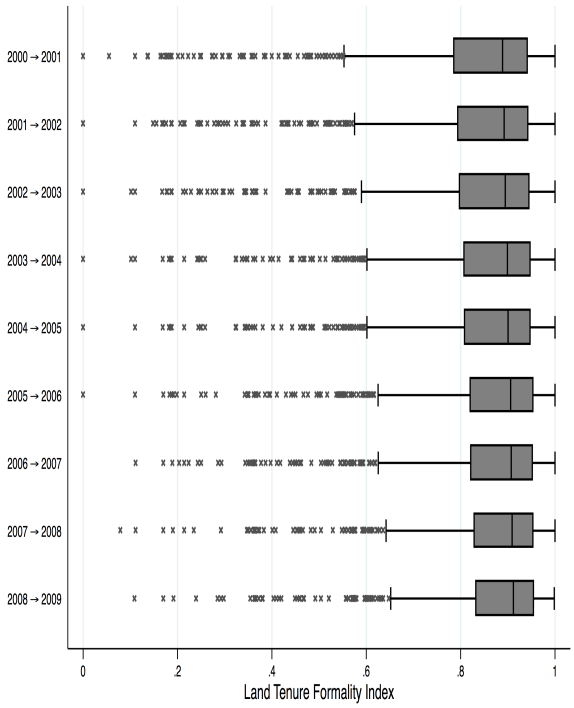
Dependent variable: Proportion of coca fields per 1000 hectares

	Municipalities with rainforest			Municipalities with presence of illegal groups			Municipalities with more than 20% on public land		
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
L.Proportion of coca fields per 1000 hectares	0.248***	0.243***	0.246***	0.286***	0.283***	0.283***	0.258***	0.251***	0.253***
	[0.036]	[0.036]	[0.031]	[0.031]	[0.031]	[0.030]	[0.046]	[0.047]	[0.043]
Land tenure formality index	-2.546***	-2.492***	-2.653***	-1.549***	-1.500***	-1.505***	-1.724***	-1.740***	-1.837***
	[0.780]	[0.787]	[0.830]	[0.299]	[0.302]	[0.299]	[0.578]	[0.577]	[0.587]
Homicide rate per 100000 inhabitants			0.003**			0.001**			0.002*
			[0.001]			[0.001]			[0.001]
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-Variant Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
No. of observations	963	963	963	6723	6723	6723	1620	1620	1620
No. of groups	107	107	107	747	747	747	180	180	180
No. of instruments	17	23	24	17	23	24	17	23	24
p-value F test of joint significance	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
p-value Arellano-Bond test for AR(1) in first differences	0.107	0.108	0.104	0.016	0.016	0.016	0.194	0.200	0.188
p-value Arellano-Bond test for AR(2) in first differences	0.231	0.233	0.252	0.247	0.247	0.251	0.408	0.406	0.434
p-value Hansen J test of overidentifying restrictions	0.579	0.562	0.473	0.402	0.405	0.432	0.461	0.458	0.422
p-value Difference-in-Hansen test of exogeneity for instrument subsets (unrestricted)	0.513	0.524	0.498	0.289	0.291	0.315	0.378	0.370	0.369
p-value Difference-in-Hansen test of exogeneity for instrument subsets (difference)	0.494	0.409	0.272	0.934	0.925	0.919	0.553	0.579	0.436

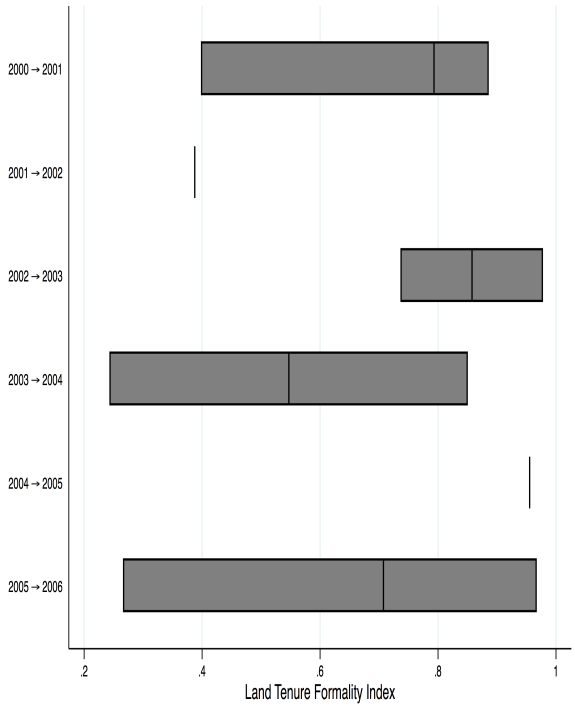
Notes - * Significant at 10%, ** significant at 5%, and *** significant at 1%. The sample of municipalities with rainforest are those municipalities that have some soil covered by rainforest. Municipalities with presence of illegal groups are those who have ever had presences of either FARC, ELN or AUC between 2000 and 2009. Municipalities with more than 20% on public land are those municipalities whom cadastral area has, at least, 20% in non-private tenure (i.e. state properties, forest, among others). Two step System GMM is implemented. We use the forward orthogonal deviations proposed by ? (?). The ? (?) finite sample correction for standard errors is employed. We use two lags instruments for the collapsed matrix. The time-variant controls include: Land quality gini index, Number of hectares per landowner, health coverage (SISBEN), Public expenditure per capita in education, Public expenditure per capita in justice per capita and Agrarian loan. The time-invariant controls were omitted due to redundancy with the split criteria. The Hansen J-test reports the p-values for the null hypothesis of instrument validity. The values reported for the Diff-in-Hansen test are the p-values for the validity of the additional moment restriction necessary for system GMM. The values reported for AR(1) and AR(2) are the p-values for first and second order autocorrelated disturbances in the first differences equations.

GRAPH 1. Land Tenure Formality Index by Change of Presence of coca over years

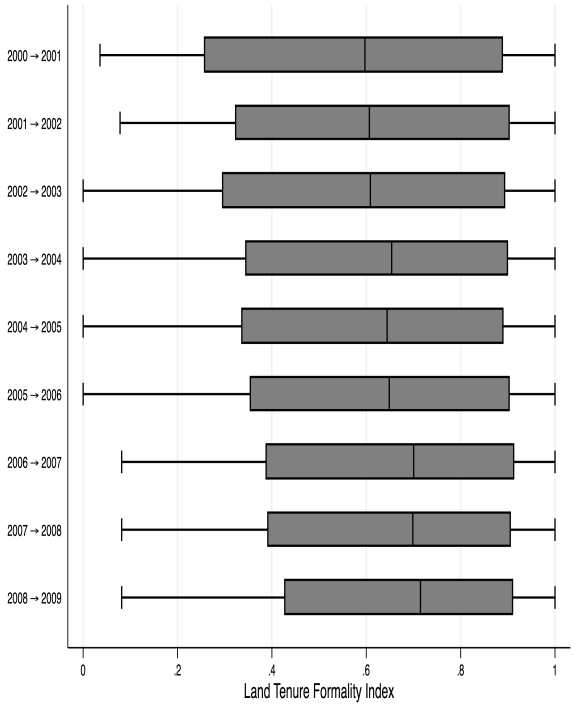
(a) Non-coca → Non-coca



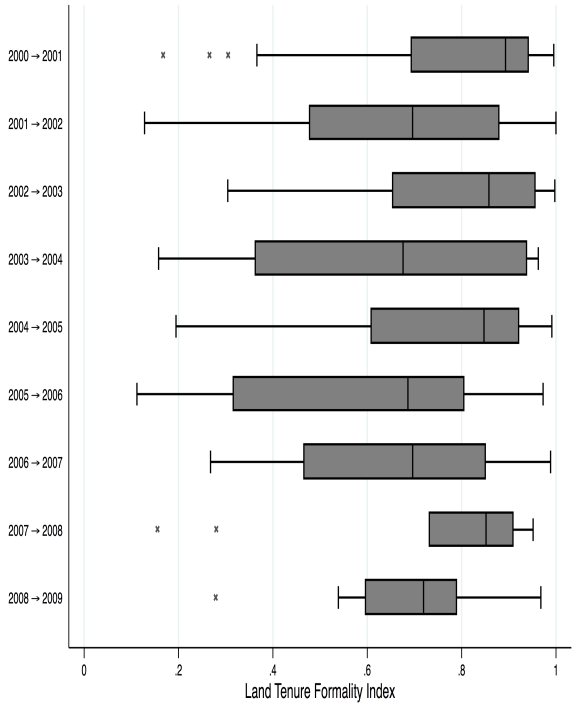
(b) Coca → Coca



(c) Non-coca → Coca

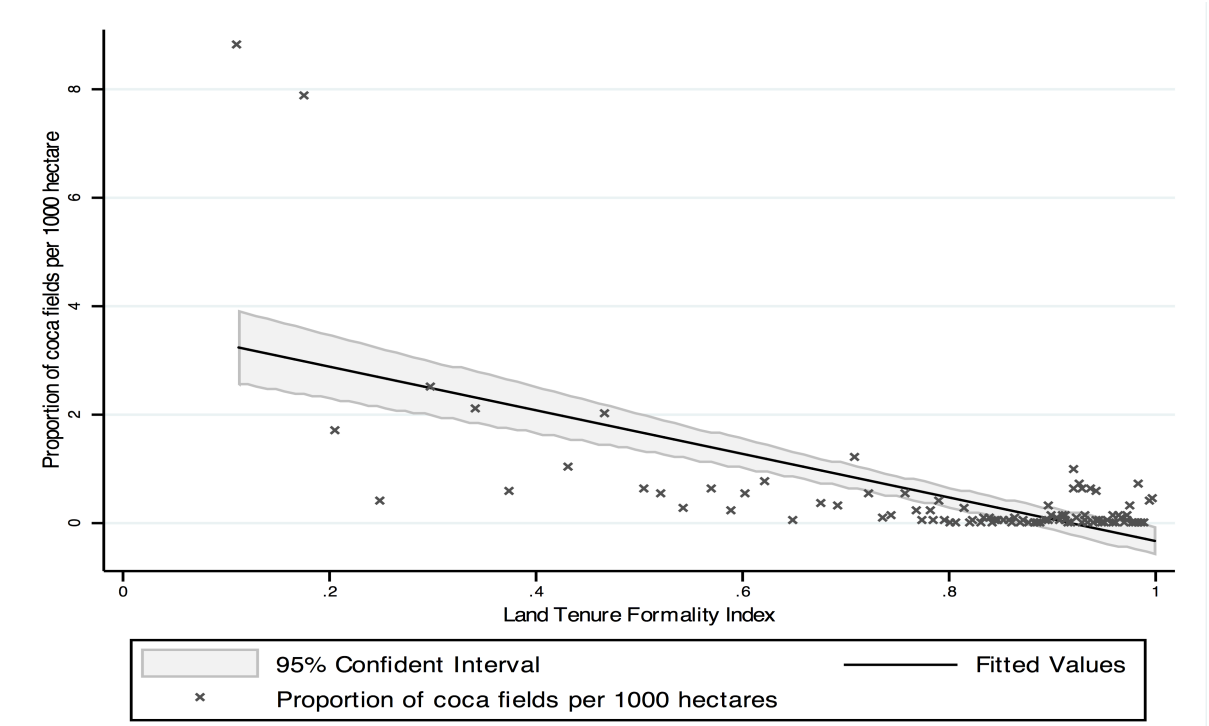


(d) Coca → No-Coca



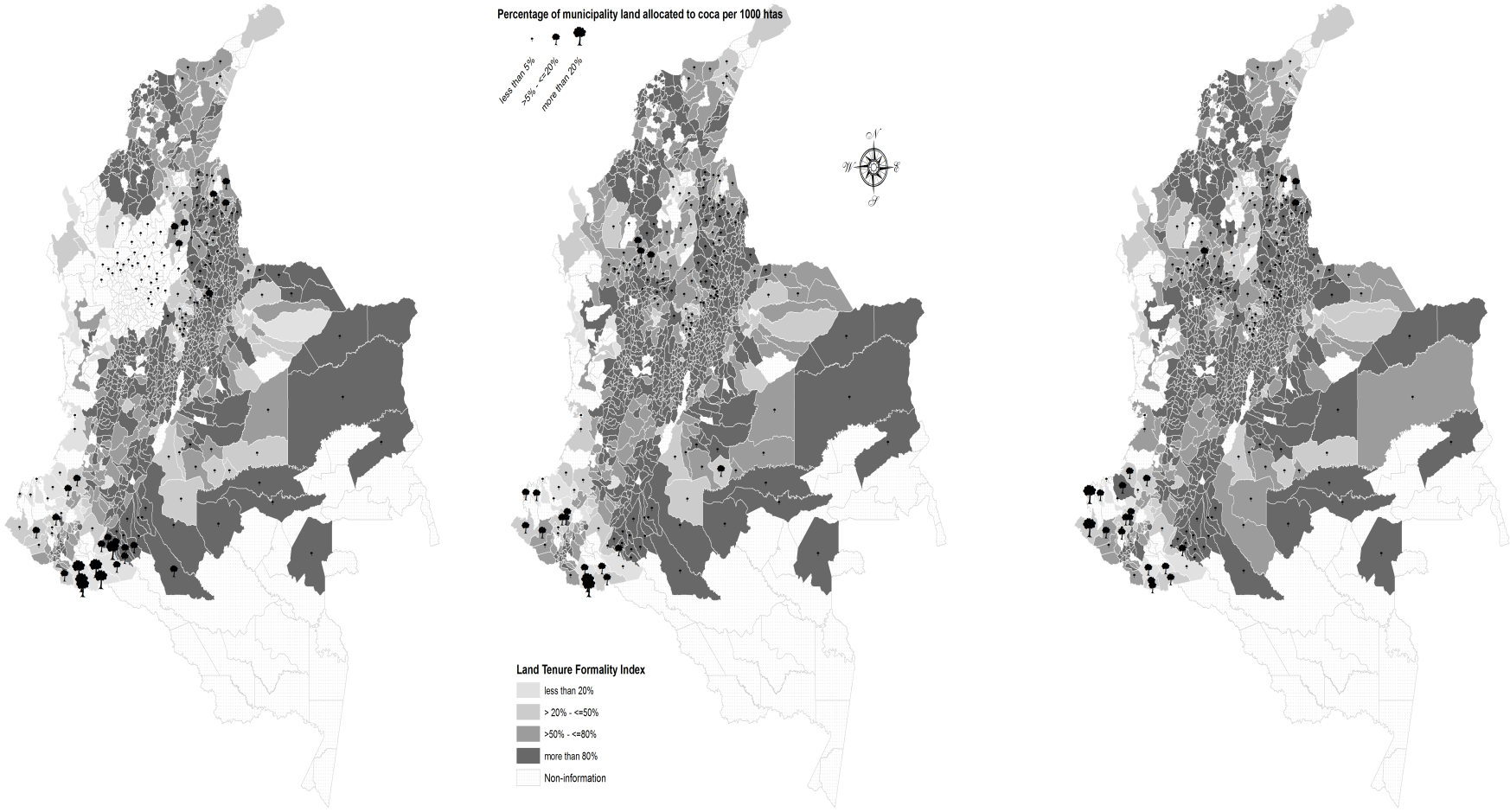
Notes - The graph describes the box plot for the Formality index for the four different variation of coca presences between two years. For instance, if we found that a given municipality had coca the year before and the current year we categorize under "*Coca → Coca*"; or, if it had coca the year before but not the current year we categorize under "*Coca → Non-coca*", and so on. Data source: CEDE, 2012.

GRAPH 2. Scatter plot by Land Tenure Formality Index quantiles.



Notes - The graphs shows the mean of the scatter plot graph for the mean of the Proportion of Municipality Coca fields per 1000 hectares by the 100 quantiles of the Land Tenure Formality Index. All the years were considered. Data source: CEDE, 2013.

GRAPH 3. Spatial distribution for Land Tenure Formality Index and percentage of municipality land allocated to coca



2000 2006 2009

Notes - All maps have the same scale in both variables. In 2000, the department of Antioquia is missing due to information availability. Data source: CEDE, 2013.