Consequences of Out-Migration for Land Use in Rural Ecuador

EXTENDED ABSTRACT FOR PAA 2011

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In many rural areas of the developing world, recent out-migration and the receipt of remittances have had dramatic consequences for population structure and the growth of cash income. An ongoing debate has considered whether these changes will undermine or promote investment in small-scale agriculture (Taylor et al. 1996; Jones 2009), with empirical results to date suggesting mixed effects (Jokisch 2002; Taylor et al. 2003). These outcomes also have important implications for environmental conservation, since out-migration could eventually lead to agricultural abandonment, reforestation, and a "forest transition" (Rudel et al. 2005). However very few quantitative studies have evaluated this hypothesis by examining the effects of migration and remittances on rural land use (for exceptions see Gray 2009; Vanwey et al. 2009; Damon 2010). We advance this literature by investigating this issue in rural Ecuador using data from both household surveys and satellite imagery.

Data were collected for this study through a specialized household survey conducted in three areas of rural Ecuador (Gray & Bilsborrow 2009). The surveys were carried out in 2008, with the collaboration of the Centro de Estudios sobre Población y Desarrollo Social in Quito, over four months in the provinces of Pichincha-Santo Domingo de los Colorados, Cañar-Chimborazo and Loja. The first area is along the transition zone of the Andes going down to the Pacific Coast, the second is strictly high Andes with some indigenous communities as well as mestizo, and the third is a dry lower highlands area. The latter has a long tradition of out-migration to internal destinations in Ecuador, the second one has been a major center of international emigration, much to Spain, for the past decade or so (though much less since 2003 when the Spanish embassy in Quito imposed restrictions on visas), and the Pichincha-Sto. Domingo area has a more diverse migration history, being a cynosure for internal migrants in the 1970s-1980s.. The survey questionnaires sought detailed data on the migrants and households using a migration history approach, from 2000 to 2008. Data collected included land ownerships and main crops each year, and more detailed data for 2007-8 on agricultural activities, including outputs and inputs. It collected both cross-sectional and retrospective data on out-migration, remittances and agricultural activities. For the communities in two of the three study areas (the third failed to have adequately cloud-free images in the key years), we also acquired and analyzed satellite imagery for the beginning and end of the study period (2000-2008), providing areal measures of land use and land cover change.

We use these data to estimate both household and community-level models of the influence of out-migration and remittances on land use. At the household level we investigate three land use outcomes measured for the agricultural season preceding the survey: area planted in annual crops, person-days of labor used, and the cost of chemical inputs. Migration is measured by the number of migrants departed since 2000, and remittances by the value of monetary remittances received from these migrants in the past 12 months before the interview. A variety of household, farm and community characteristics are included as additional variables. To account for skewness and censoring of outcomes, we transform them by ln(y+1) prior to analysis and estimate both linear and tobit models. To account for the potential endogeneity of migration and remittances, we use lagged values of the predictors from the year 2000 and also explore the use of measures of household age structure and the existence of migrant networks as instrument for migration and remittances. All models also include canton or county-level fixed effects, sampling weights to compensate for the complex survey design, and corrections for clustering at the community level.

At the community-level, we examine three additional land use outcomes: proportion of the community area in annuals in 2008, change in NDVI (normalized difference vegetation index, a measure of vegetation greenness) from 2000 to 2008, and change the EVI (enhanced vegetation index, an alternative to NDVI). Migration is measured as the ratio of post-2000 migrants to adult non-migrants in the community. Control variables include various biophysical, socioeconomic and agricultural characteristics of the communities, as well as canton-level fixed effects.

Preliminary results are presented below. Table 1 presents the results from un-instrumented household-level tobit models, which are similar to the results from parallel instrumental variable models with migration and remittances included as endogenous predictors. The results indicate that migration and remittances had countervailing effects on area in annuals but did not significantly affect the use of labor or modern chemical inputs. Cultivated area expands in response to out-migration, likely in order to substitute for the lost income of the departed household member (many of whom worked as agricultural laborers), but then shrinks in response to remittances. To extend this analysis we will estimate net effects for households with various types of migrants. At the community level, the positive effect of migration on agriculture is also evident as NDVI and EVI (i.e., greenness) both increase with the ratio of migrants to non-migrants, though no effect is evident on cross-sectional land cover in annuals.

This abstract is incomplete and the results strictly preliminary. In the complete paper we will further explore the data, with different variations of the models, quite possibly finding different results. We will discuss the models and results in detail, as well as their implications for the "forest transition" debate and the future of these rural communities.

Selected References

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Table 1. Household-level tobit models of the influence of migration and remittances on agricultural activities.

Predictor	Ln(area in annuals)		Ln(days of labor)		Ln(input costs)	
Migration and remittances						
Number of migrants, 2000-08	0.08	**	0.03		0.00	
Ln(value of remittances), 2008	-0.04	**	0.01		-0.05	
Farm characteristics						
Ln(area of land owned), 2000	0.16	**	0.65	**	0.44	*
Land quality moderate	0.20	+	0.13		1.21	*
Land quality high	0.21	*	0.29	*	1.18	**
Land quality very high	0.13	*	0.34	*	0.76	
Owned land with irrigation, 2000	-0.16	*	0.16		0.53	
Ln(number of cattle), 2000	0.05		-0.21	*	0.15	
Other household characteristics						
Household size, 2000	0.01		0.01		0.08	
Age of head, 2000	0.03	*	0.03		0.10	
Age of head squared, 2000	0.00	*	0.00	+	0.00	
Female head, 2000	-0.06		-0.21		-0.46	
Education of head, 2000	-0.01		-0.03		0.10	
Nonagricultural work by head, 2000	-0.03		-0.12		1.50	*
Nonagricultural wealth score, 2000	0.00		-0.12	*	0.36	
Community characteristics						
Paved road, 2000	0.20	*	0.07		-1.65	**
Gravel road, 2000	0.04		0.25	+	-0.88	
Tropical climate score	-0.01		0.26	**	0.51	**
Canton-level fixed effects	Yes		Yes		Yes	
Constant	-0.41		2.46	**	-3.49	
Sigma	0.45	**	0.97	**	2.54	**
N	438		441		437	

+ p<0.10, * p<0.05, ** p<0.01

Table 2. Community-level OLS models of LULC in Loja and Canar/Chimborazo.

Predictor	Percent annuals, 2008		Change in NDVI, 2000-08		Change in EVI, 2000-08	
Migration						
Percent migrants, 2000-2008	0.01		0.55	*	0.95	*
Biophysical characteristics						
Mean annual precipitation	0.00	+	0.00		0.01	
CV of monthly precipitations	0.02	*	0.21	**	0.28	**
Experienced drought, 2000-08	0.03	+	0.26	**	0.34	**
Mean annual temperature	-0.02	*	-0.18	**	-0.25	**
SD of monthly temperatures	0.00		-0.04		0.04	
Mean land slope, 2000	0.00		0.06	**	0.06	*
SD of land slope, 2000	-0.01	*	-0.14	**	-0.11	*
Black soil predominant, 2000	0.00		0.17		0.33	*
Forest present, 2000	-0.02		-0.12		-0.13	
Agricultural characteristics						
Irrigation present, 2000	0.01		0.06		0.06	
Maize cultivated, 2000	0.04		0.09		0.26	
Coffee cultivated, 2000	0.01		0.08		0.08	
Potatoes cultivated, 2000	-0.04	*	-0.39	**	-0.58	**
Peanuts cultivated, 2000	-0.02		-0.25		-0.13	
Cattle raised, 2000	-0.02		-0.22	*	-0.33	**
Socioeconomic characteristics						
Population size, 2000	0.00		0.00	*	0.00	*
Mean community education, 2000	-0.01		-0.06	+	-0.11	+
NDVI, 2000			-0.39	**		
EVI, 2000					0.05	
Canton-level fixed effects	Yes		Yes		Yes	
Constant	0.74	**	5.54	**	5.75	**
N	78		78		78	

+ p<0.10, * p<0.05, ** p<0.01