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Gender-specific out-migration, deforestation and urbanization in the Ecuadorian Amazon

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Abstract

The Ecuadorian Amazon, one of the richest reserves of biodiversity in the world, has faced one of the highest rates of deforestation of any Amazonian nation. Most of this forest elimination has been caused by agricultural colonization that followed the discovery of oil fields in 1967. Since the 1990s, an increasing process of urbanization has also engendered new patterns of population mobility within the Amazon, along with traditional ways by which rural settlers make their living. However, while very significant in its effects on deforestation, urbanization and regional development, population mobility within the Amazon has hardly been studied at all, as well as the distinct migration patterns between men and women. This paper uses a longitudinal dataset of 250 farm households in the Northern Ecuadorian Amazon to understand differentials between men and women migrants to urban and rural destinations and between men and women non-migrants. First, we use hazard analysis based on the Kaplan–Meier (KM) estimator to obtain the cumulative probability that an individual living in the study area in 1990 or at time t , will out-migrate at some time, $t+n$, before 1999. Results indicate that out-migration to other rural areas in the Amazon, especially pristine areas is considerably greater than out-migration to the growing, but still incipient, Amazonian urban areas. Furthermore, men are more likely to out-migrate to rural areas than women, while the reverse occurs for urban areas. Difference-of-means tests were employed to examine potential factors accounting for differentials between male and female out-migration to urban and rural areas. Among the key results, relative to men younger women are more likely to out-migrate to urban areas; more difficult access from farms to towns and roads constrains women's migration; and access to new lands in the Amazon—an important cause of further deforestation—is more associated with male out-migration. Economic factors such as engagement in on-farm work, increasing resource scarcity—measured by higher population density at the farm and reduction in farm land on forest and crops—and increase in pasture land are more associated with male out-migration to rural areas. On the other hand, increasing resource scarcity, higher population density and weaker migration networks are more associated with female out-migration to urban areas. Thus, a “vicious cycle” is created: Pressure over land leads to deforestation in most or all farm forest areas and reduces the possibilities for further agricultural extensification (deforestation); out-migration, especially male out-migration, occurs to other rural or forest areas in the

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32 Amazon (with women being more likely to choose urban destinations); and, giving continuing population growth and
33 pressures in the new settled areas, new pressures promote further out-migration to rural destinations and unabated
34 deforestation.

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36 *Keywords:* Ecuadorian Amazon; out-migration; gender differences; deforestation; urbanization

37

38 1. Introduction

39 The Ecuadorian Amazon, one of the richest
40 reserves of biodiversity in the world (Myers et al.,
41 2000), has faced one of the highest rates of
42 deforestation of any Amazonian nation, with huge
43 losses of biodiversity and natural resources (FAO,
44 2001). Most of this forest elimination has been caused
45 by agricultural colonization that followed the discovery
46 of oil fields in 1967.

47 Recent evidence indicates profound changes in
48 population mobility in areas of agricultural coloniza-
49 tion in the Ecuadorian Amazon frontier. Following the
50 earlier large-scale migration influxes from long-settled
51 regions, the most dramatic forms of population
52 mobility under way are currently within the frontier.
53 Rural plots have, on average, become much smaller in
54 the 1990s, from 45.9 ha in 1990 to 25.3 ha in 1999 as
55 a consequence of population growth—continuing in-
56 migration and high fertility—which generate a demand
57 for land that exceeds the limited supply in the
58 traditional areas of occupation (Barbieri et al.,
59 2003). In particular, the Total Fertility Rate—TFR—in
60 the Amazon was 5.5 children per woman in 2000
61 (CEPAR, 2000). Thus, more and more rural house-
62 holds see permanent out-migration of one or more
63 family members as a way of earning cash income and
64 diversifying risk. This strategy helps alleviate depend-
65 ence on dwindling forest resources. As farms have
66 atrophied over time, primary forests within farms have
67 become scarce in the study area in the Ecuadorian
68 Amazon: While farms had, on average, 59% of their
69 lands on forests in 1990, this proportion declined to
70 45% in 1999 (Barbieri et al., 2003).

71 In addition to deforestation on original farms,
72 population surpluses in traditional frontier areas in
73 the Ecuadorian Amazon have moved to less occupied
74 or unoccupied areas, engendering further deforestation.
75 Furthermore, rural–urban mobility has led to

increasing urbanization, with recent growth among
long-settled river towns, formation of new pioneer
urban areas, and the incipient transformation of many
rural communities, which are acquiring urban charac-
teristics through population growth and acquisition of
basic infrastructure. Increasing economic and social
articulation is also evolving between larger and
smaller urban communities, constituting an incipient
but increasing and complex network of urban places
in the Amazon. Urban growth in the Amazon has
occurred without correspondent improvements in
infrastructure, such as sanitation, garbage disposition
and treated water, and accessibility to health and
family planning facilities.

While very significant in its effects on deforestation
and urbanization, population mobility within the
Amazon has hardly been studied. Furthermore, the
gender dimension involved in migration patterns,
another neglected issue in the empirical literature on
population living in rural areas of the developing
world (Radcliffe, 1991; Chant and Radcliffe, 1992;
Lawson, 1998; Deere and Leon, 2003), can be
regarded as crucial to understand processes of land
use, population redistribution, urbanization and defor-
estation in places such as the Amazon. Previous work
in our study area suggests that important gender
differences exist between migrants. For example,
young women are more likely than young men to
leave their parent's households and to choose urban
destinations in order to marry, study or work, while
men are usually less mobile and are more likely to
engage in farm work (Laurian et al., 1998). Radcliffe
(1992) also suggests that women tend to out-migrate
more from rural areas in the Peruvian Andes to larger
towns, while men tends to migrate more to rural and
intermediate urban areas.

Social and cultural factors are also likely to play a
key role in defining gendered migration in the Amazon.
In particular, intra-household gender differences

115 engendering migration should be understood in the
 116 context of cultural and historical processes operating at
 117 specific places (Lawson, 1998). The high mobility of
 118 younger and unmarried women in Latin America,
 119 especially to urban areas, is likely to be explained by
 120 the “social construction of female labor” as a marginal
 121 one, having small usefulness in extra-household work
 122 (Radcliffe, 1991). Chant and Radcliffe (1992) suggest
 123 that migration networks and links between migrants
 124 and areas of origin in Latin America tend to be more
 125 important for married women, since they usually attach
 126 more value to family and community ties than men. As
 127 a result, “while women might migrate as individuals,
 128 decisions on their movement may be strongly circum-
 129 scribed by other members of the family unit or kin” (p.
 130 14-5). Chant (1992) also associates a higher predom-
 131 inance of female rural–urban migration in Costa Rica to
 132 family, rather than individual, strategies which do not
 133 necessarily aim to maximize income. Women supports
 134 the migration of other household members (especially
 135 husbands, older brothers, sons and daughters) as a
 136 mechanism to provide better access to services such as
 137 education, health and housing.

138 The hypothesis in this study is that characteristics
 139 of household members, as well as transportation
 140 infrastructure linking farms to towns and roads, and
 141 characteristics of farm households, are different
 142 between men and women migrants and non-migrants
 143 in ways that predict gender-specific migration desti-
 144 nations. This hypothesis is predicated on the notion
 145 that agricultural extensification and population growth
 146 in the Amazon generates increasing demand for new
 147 agricultural land and an increasing pattern of land
 148 fragmentation. This demand is partially met through
 149 migration to new agricultural frontiers. Since young
 150 men are more likely than young women to out-
 151 migrant to other rural areas in the Amazon, this
 152 migration gender imbalance is likely a key component
 153 behind forest conversion that has been ignored in
 154 previous studies. Conversely, a key to understanding
 155 the rapid urbanization of the Ecuadorian Amazon is to
 156 examine how rural transformations in the frontier and
 157 rural–urban articulations have engendered higher
 158 impact on female rural out-migration compared to
 159 male out-migration. In this study we examine differ-
 160 ences between men and women migrants to rural and
 161 urban destinations and differences between men and
 162 women non-migrants.

2. Study area

The colonist study area is located in the western
 Amazon Rain Forest, and in the Northern Ecuadorian
 Amazon. Together with the Coastal region and the
 Highlands (“Sierra”), the Ecuadorian Amazon (a
 region also known as the “Oriente”) represents the
 three distinct landscapes of the country (Fig. 1).

The study area is a sparsely populated tropical
 lowland rainforest. The altitude varies from the
 Andean foothills to about 200 m above sea level,
 with the study area 350–250 m, straddling the
 Equator, with annual rainfall of 3–5 m. Soil
 conditions are generally better than in the lower
 Amazon of Peru or Brazil, as a result of pockets of
 volcanic (black) soils, although soil quality is highly
 variable and much is poor quality red soils with high
 acidity and aluminum toxicity. The Ecuadorian
 Amazon offers a year-round growing season, with
 rain occurring in all 12 months, and thus allowing
 the use of slash and mulch clearing practices (cutting
 trees and leaving them to decompose), with little
 burning of trees or agricultural residues such as in
 the Brazilian Amazon. Nevertheless, by the late
 1990s there appeared evidence of micro-climatic
 changes in some areas, perhaps due to the loss of
 vegetation, resulting in drier conditions in certain
 months.

The study area began to be occupied by agricul-
 tural settler families after the discovery of oil in
 1967, which was followed by the laying of pipelines
 and a road network for the exploitation of oil, and by
 the establishment of town of Lago Agrio. From the
 mid-1970 to the present, the oil exploited in the
 study area in the Northern Amazon has been
 responsible for half or more of both foreign
 exchange earnings and government revenues in
 Ecuador. Despite being extensively occupied by
 agricultural settlers, the region still attracts migrants
 from other parts of Ecuador, especially the Sierra.
 Virtually all of the colonization in the Ecuadorian
 Amazon has been spontaneous, with most of the
 colonists being poor and arriving without capital to
 invest in their plots, and facing a lack of infra-
 structure and governmental assistance. In fact, the
 Ecuadorian government has historically relied on
 “laissez-faire” policies towards the Amazon, with
 few limitations or regulations to the development of

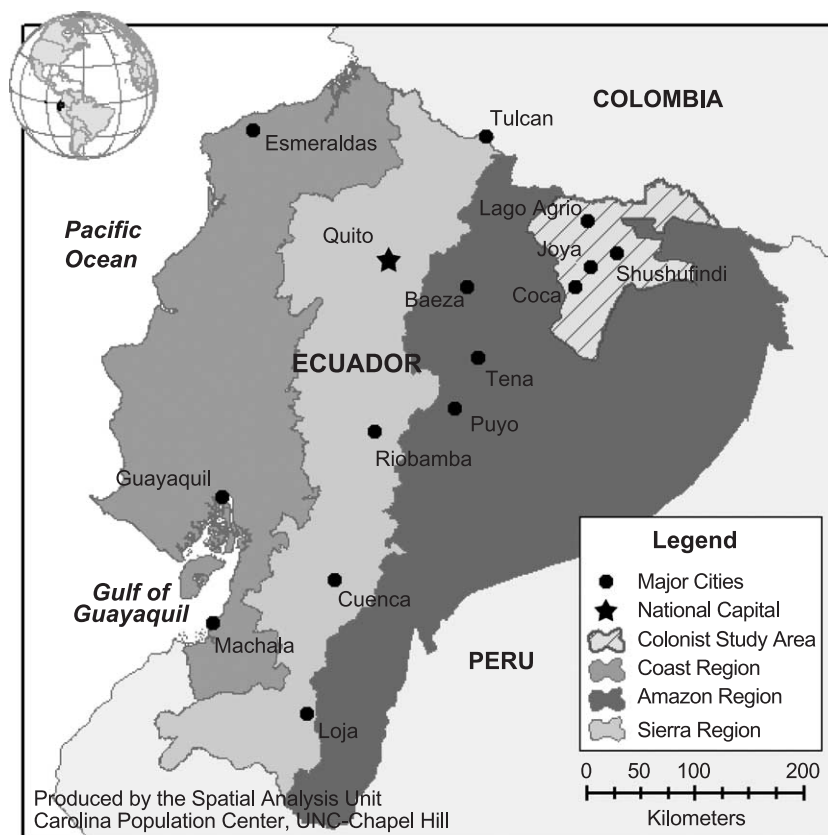


Fig. 1. Study area in the Northern Ecuadorian Amazon.

210 the oil industry, and no directed efforts towards
211 planning agricultural colonization (Bilsborrow,
212 1998).

213 As a consequence of this colonization process and
214 oil extraction activities, the Northern Amazon study
215 region has experienced high rates of deforestation,
216 with forest cover on sample farms falling from
217 virtually 100% in the 1960s to 59% in 1990, and
218 further to 45% in 1999. There are now four main
219 towns in the study area: Lago Agrio (the largest, with
220 34,000 people, according to the 2001 Ecuadorian
221 census), Coca, Joya and Shushufindi. The total
222 population in the Ecuadorian Amazon in 1990 was
223 384,582—4% of the Ecuadorian population (INEC,
224 1992). The population in 2001 was about 550,000—
225 5% of the Ecuadorian population, following 30%
226 growth over 1990–1999 vs. 22% nationally (INEC,
227 2001).

3. Data and methods

228
229 Farm households in the study area were selected in
230 1990 using a two-stage cluster sample. The 1990
231 survey was conducted by Francisco Pichón and
232 Richard Bilsborrow (who also conducted a follow-
233 up survey in 1999) from The University of North
234 Carolina at Chapel Hill. Pichón and Bilsborrow used
235 crude maps and lists of approved settlement areas in
236 the northern Amazon, from which they obtained a
237 sample frame of sectors (settlement areas), with each
238 sector comprising a number of farm households. The
239 sampling frame contained the total number of farm
240 households for all sectors, and was used to select
241 systematically a sample of 64 sectors from the nearly
242 300 in the region. In the second stage, a cluster of 5–
243 10 contiguous farm households was randomly
244 selected from each of the selected sectors, based on

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245 the size of the sector, to achieve a PPS probability
246 sample. Through this process, 418 farm households
247 were selected, which represented a 5.9% sample of the
248 rural population of the Northern Ecuadorian Amazon.

249 In 1999, a follow-up survey was conducted and the
250 same plots of land in 1990 were visited, which
251 required interviewing all the farm households on
252 any of the subdivisions of the original plots. Through
253 an inspection of each questionnaire in 1990 and 1999,
254 250 farm households were identified for which the
255 head of the household and/or his spouse was the same
256 in 1990 and 1999. Thus, it is possible to identify 2086
257 individuals (54% men and 46% women) living at any
258 point during the 1990s in the 250 nuclear households
259 surveyed in 1990 in 1999. This number includes those
260 who were born, died or out-migrated during the
261 decade.¹

262 “Out-migrants” are defined as those individuals
263 between 12 and 59 years of age who left the farm
264 household permanently to live in a rural or urban area
265 elsewhere between 1990 and the interview date in
266 1999. The Kaplan–Meier (KM) estimator, or alter-
267 natively product-limit estimator (Allison, 1995), gives
268 the cumulative probability that an individual living in
269 the study area at time t ($t=1990, \dots, 1998$), out-
270 migrated at some point, $t+n$, before or during 1998:²

$$OM(t) = \prod_{i:j:t \leq t} [d_j^* n_j^{-1}] \quad (1)$$

271 where $OM(t)$ represents the cumulative probability, at
272 time t , that an individual will out-migrate and \prod
273 represents the sum of all events (i.e., out-migration)
274 that are less than or equal to t . The subscript j
275 represents a specific year, $j=1=1990, j=2=1991$ and so
276 on; d_j represents the number of out-migrants at time j ,
277 and n_j represents the number of individuals at risk of
278 out-migration at time j .

280 Out-migration is measured as a multinomial
281 variable, indicating if an individual did not move,
282 moved to an urban area, or moved to a rural area. In

order to understand possible factors affecting out- 283
migration differentials according to destination and 284
gender, variables mentioned in the literature as 285
determinants of out-migration in frontier areas are 286
identified and analyzed through difference-of-means 287
tests, which estimate the significance of the difference 288
between men and women for a specific variable. Thus, 289

$$t(X_f - X_m) = (X_f - X_m) / \sigma(X_f - X_m) \quad (2)$$

$$\sigma(X_f - X_m) = \sqrt{[(s_f^2/n_f - 1) + (s_m^2/n_m - 1)]} \quad (3)$$

with $t(X_f - X_m)$ representing the difference-of-means 292
test. Subscripts f and m represent, respectively, 293
females and males, and X represents the mean for a 294
given variable. $\sigma(X_f - X_m)$ represents the unequal 295
variance between males and females; this inequality 296
should be assumed given the large sample size in this 297
study. That is, since the population of men and women 298
for a specific out-migration status does not have equal 299
standard deviations, variances for men and women 300
must be estimated separately. Symbols s and n 301
represent, respectively, the standard error and sample 302
size for X , according to gender. 303

The means for the variables in Eqs. (2) and (3) 304
represent demographic and individual attributes 305
affecting out-migration, as well as farm household 306
characteristics and the transportation network linking 307
farms to towns and roads in the region. 308

4. Results 309

4.1. Out-migration by gender and destination 310

Table 1 shows the number and percentage of out- 311
migrants between 12 and 59 years of age over the 312
period 1990–1999, according to their place of 313
destination and gender. Most of the 250 farm house- 314
holds in the study area (147 or 59% of the total) had at 315
least one out-migrant between 1990 and 1999, with a 316
similar number between farm households with at least 317
one male or one female out-migrant. Men represented 318
58% of all out-migrants in this period, compared to 319
42% women. Most of the out-migrants in the study 320
area choose rural destinations (68%), with men being 321
more likely to move to rural areas than women (42% 322
vs. 26% of total out-migrants). Rural–urban migration 323

¹ A total of 1778 individuals were living in the farm households in 1990, and 308 were born after the 1990 survey and before the 1999 survey.

² Since data was collected during the first semester of 1999, it does not include all out-migrants in this year (from January 1 to December 31). Thus, data for 1999 was not included in the KM estimator.

t1.1 Table 1

t1.2 Total number of permanent out-migrants between 12 and 59 years of age from the Northern Ecuadorian Amazon, between 1990 and 1999,
t1.3 according to place of destination, gender, and age group

t1.4		Number of households with out-migrant(s) (total=250 households)	Total		Rural		Urban	
			Out-migrants, <i>N</i>	Out-migrants, % of total	Out-migrants, <i>N</i>	Out-migrants, % of total	Out-migrants, <i>N</i>	Out-migrants, % of total
t1.5	Male	110	203	57.8	148	42.2	55	15.7
t1.6	12–19 years old		94	26.9	67	19.1	27	7.7
t1.7	20–34 years old		88	25.1	66	18.8	26	7.4
t1.8	34–59 years old		20	5.8	15	4.3	2	0.6
t1.9	Female	116	148	42.2	92	26.2	56	16.0
t1.10	12–19 years old		100	28.6	61	17.4	41	11.7
t1.11	20–34 years old		40	11.4	26	7.4	13	3.7
t1.12	34–59 years old		8	2.2	5	1.4	2	0.6
t1.13	Total	147	351	100.0	240	68.4	111	31.6

324 is relatively more important for women when compared to men; despite comprising a smaller proportion of the total number of out-migrants compared to men (42%), women had the same proportion of out-migrants choosing urban destinations (16%). In fact, while the ratio of those choosing rural destinations instead of urban destination is 2.7 for men (42.2% divided by 15.7%), the ratio is 1.6 for women. Important gender differences are also noticed when considering age groups. Male out-migrants are more evenly distributed between age groups 12–19 and 20–34 for both rural and urban destinations, while female out-migrants are more concentrated in the youngest age group, especially for those choosing urban destinations. The relatively smaller proportion of female out-migrants between 20 and 34 years of age probably reflects smaller employment opportunities in urban areas for older (and most likely married) women, as well as the transition to an out-migration pattern in which female mobility, especially to rural areas, is more associated with family migration (that is mobility tied to spousal or familial migration).

346 Fig. 2 illustrates the dynamics of out-migration between 1990 and 1998.³ It shows, by gender and destination, the annual cumulative probabilities of out-migration from the Ecuadorian Amazon between 1990 and 1998. While urbanization is a growing process in the Amazonian study area, Fig. 2 shows

that most of the out-migrants choose rural destinations in other areas in the Amazon, thus engaging in further deforestation, exacerbated by a male bias for rural out-migration. While the cumulative probability that a man between 12 and 59 years of age living in the study area in 1990 will out-migrate to a rural area by the end of 1998 is 24%, the probability for a woman between 12 and 59 years of age is 19%.

Conversely, compared to men, women between 12 and 59 years of age living in the study area in 1990 are more likely to out-migrate to urban areas (15–12%) by the end of 1998, probably due to the availability of female-dominated domestic employment and employment in the tertiary sector, or migration due to family reasons—for example, the female spouse living in town with children pursuing education, or providing domestic work, to family members working in a town.

4.2. Factors associated with out-migration

Table 2 presents means, standard deviations and difference-of-means tests for demographic and individual attributes potentially affecting out-migration from the study area in the Ecuadorian Amazon between 1990 and 1999, when controlled by out-migration destination and gender. Younger people, especially between 16 and 25 years of age, traditionally are the most likely migrants, irrespective of spatial and temporal contexts (Ravenstein, 1889; Lee, 1966; Bilborrow et al., 1984; Laurian et al., 1998; VanWey, 2003). Consistent with the migration literature, the results show that the mean age for out-

³ Since data was collected during the first semester of 1999, it does not include all out-migrants in this year (from January 1 to December 31). Thus, data for 1999 was not included in Fig. 2.

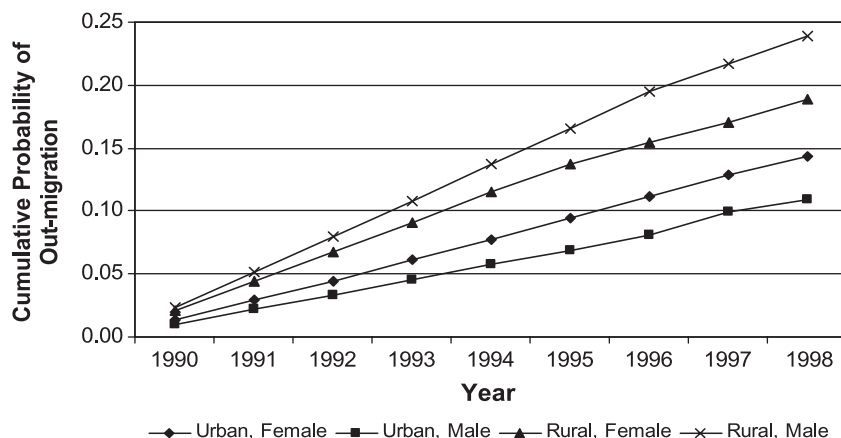


Fig. 2. Cumulative probability that an individual will out-migrate from the farm household in the Northern Ecuadorian Amazon between 1990 and 1998, according to place of destination and gender.

383 migrants is considerably lower compared to non-
384 migrants, especially among women. The highly
385 significant difference-of-means between men and
386 women suggest that women are more likely to out-
387 migrate at younger ages compared to men, especially
388 to urban destinations.

389 *Number of persons in the household* varies relative
390 to out-migration outcomes. Table 2 shows significant
391 differences between men and women relative to
392 household size; especially notable is the higher means
393 among out-migrants choosing rural areas compared to
394 those choosing urban areas. Male out-migrants to rural
395 areas come from larger households than women, while

the choice for an urban destination does not seem to
be related to household size differences. Lastly,
women who do not move are more likely to live in
larger households than men.

Engagement in farm work measures if an individ-
ual who lived in the farm household was fully
engaged in farm work during the 1990s or, conversely,
if he/she was not usually engaged in farm work during
the 1990s. We anticipate that lack of engagement in
farm work should have a positive effect on out-
migration, since it means the desire (or necessity) for
employment alternatives to on-farm work. The differ-
ence between men and women is highly significant

t2.1 Table 2

t2.2 Means, standard deviations and difference-of-means test^a of variables measuring individual attributes and demographic characteristics in the
Northern Ecuadorian Amazon, 1990–1999, according to gender and out-migration destination

Variable	Rural out-migrants		Urban out-migrants		No-out-migrants	
	Female mean (S.D.)	Male mean (S.D.)	Female mean (S.D.)	Male mean (S.D.)	Female mean (S.D.)	Male mean (S.D.)
t2.5 Age	20.16 (8.15)	23.35*** (8.91)	18.52 (5.84)	21.35*** (6.87)	30.48 (13.66)	29.49*** (14.08)
t2.6 Number of persons in the household	8.90 (5.02)	9.35* (5.01)	7.53 (2.88)	7.35 (2.70)	8.13 (4.45)	7.72*** (4.22)
t2.7 Engagement in farm work (1=engaged, 0=not engaged)	0.56 (0.50)	0.92*** (0.28)	0.51 (0.50)	0.83*** (0.38)	0.56 (0.50)	0.82*** (0.38)
t2.8 Household's head education (1=at least some secondary)	0.32 (0.47)	0.38** (0.48)	0.29 (0.46)	0.38** (0.49)	0.41 (0.49)	0.41 (0.49)
t2.9 Number of previous out-migrants in the household	1.94 (2.56)	1.98 (2.34)	1.99 (2.46)	2.30* (2.51)	1.52 (2.17)	1.67*** (2.25)

t2.10 ^a Difference-of-means test (Cochran method) between males and females are showed in the column with results for males.

t2.11 * $p < 0.10$ (two-tailed test).

t2.12 ** $p < 0.05$ (two-tailed test).

t2.13 *** $p < 0.01$ (two-tailed test).

409 for both out-migrants and those not moving, indicat- 436
 410 ing evidence of traditional gender roles, with women 437
 411 being more engaged in domestic or auxiliary work on 438
 412 the farm and men being more engaged in on-farm 439
 413 work. Male out-migrants to rural areas had substan- 440
 414 tially more on-farm experience compared to men 441
 415 choosing urban areas, revealing a linkage between a 442
 416 higher rural employment background and out-migra- 443
 417 tion to other rural areas. Women are overall less 444
 418 engaged in on-farm work, regardless of being an out- 445
 419 migrant or not. 446

420 *Household's head education* measures the general 447
 421 household human capital (VanWey, 2003), and indi- 448
 422 cates the influence of the (usually male) household 449
 423 head's education on shaping other household mem- 450
 424 bers' decision to out-migrate. It represents the head's 451
 425 capacity to assimilate information about employment 452
 426 opportunities elsewhere and transmit them to house- 453
 427 hold members. The difference-of-means test is sig- 454
 428 nificant only for out-migrants. Men were significantly 455
 429 more likely than women to out-migrate from house- 456
 430 holds where the household head studied at the 457
 431 secondary school level, showing their better ability 458
 432 to benefit from a higher household human capital. 459

433 *Number of previous migrants* measures the number 460
 434 of former household members who out-migrated from 461
 435 the farm household before a given time, t . Previous 462

436 migration experiences in the household is likely to 437
 438 engender further mobility of household members due 439
 439 to their effect on personal aspirations in terms of 440
 440 welfare and income, and by creating a network of 441
 441 socioeconomic support and information between 442
 442 former out-migrants and potential out-migrants (see 443
 443 Massey, 1990). The means for non-migrants are 444
 444 substantially lower compared to those out-migrating, 445
 445 suggesting an important association between out- 446
 446 migration and number of previous out-migrants from 447
 447 the farm household. Male out-migrants to urban areas 448
 448 come from households with a significantly higher 449
 449 number of previous out-migrants compared to 450
 450 women. This suggests that a smaller number of 451
 451 previous out-migrants are sufficient to affect women's 452
 452 decision to move to urban areas relative to men. 453

454 *Table 3* shows differences in farm household 455
 455 characteristics and transportation infrastructure link- 456
 456 ing farms to towns and roads in the region, when 457
 457 controlled by out-migrants destination and gender. 458
 458 *Population density at the farm* (proportion of the 459
 459 number of people living on the farm relative to the 460
 460 farm area) measures the farm capacity to sustain 461
 461 household members, for a given amount of land and 462
 462 population living on the farm. A higher number of 463
 463 persons in the household for a fixed amount of land 464
 464 over the years can mean smaller returns to labor, and 465

t3.1 Table 3

t3.2 Means, standard deviations and difference-of-means test^a of variables measuring farm household characteristics and transportation infrastructure in the Northern Ecuadorian Amazon, 1990–1999, according to gender and out-migration destination

Variable	Rural out-migrants		Urban out-migrants		No out-migrants	
	Female mean (S.D.)	Male mean (S.D.)	Female mean (S.D.)	Male mean (S.D.)	Female mean (S.D.)	Male mean (S.D.)
t3.5 Population density at the farm (people per ha)	0.22 (0.13)	0.23** (0.14)	0.36 (0.74)	0.22*** (0.21)	0.24 (0.34)	0.23* (0.32)
t3.6 Walking distance to the nearest road (km)	0.68 (1.29)	0.98** (1.60)	0.64 (1.36)	0.73 (1.37)	0.88 (1.45)	0.83 (1.45)
t3.7 Distance to the nearest market (km)	23.82 (15.03)	27.31*** (17.76)	24.44 (19.53)	27.20** (18.88)	26.42 (16.57)	27.06* (17.76)
t3.8 Difference in amount of land in crops, 1999–1990 (ha)	-7.86 (6.46)	-7.92 (5.78)	-7.86 (6.42)	-7.00** (5.33)	-8.62 (6.35)	-8.87* (6.68)
t3.9 Difference in amount of land in pasture, 1999–1990 (ha)	-2.73 (40.16)	-0.51 (14.72)	4.61 (11.48)	5.75** (14.85)	-1.80 (33.79)	-1.80 (35.41)
t3.10 Difference in amount of land in forest, 1999–1990 (ha)	-10.94 (19.13)	-17.31*** (41.74)	-11.55 (21.24)	-8.32** (19.22)	-9.02 (23.04)	-8.99 (28.06)

t3.11 ^a Difference-of-means test (Cochran method) between males and females are showed in the column with results for males.

t3.12 * $p < 0.10$ (two-tailed test).

t3.13 ** $p < 0.05$ (two-tailed test).

t3.14 *** $p < 0.01$ (two-tailed test).

463 thus increased out-migration pressure (see, e.g.,
 464 Walker and Homma, 1996; Perz, 2001; McCracken
 465 et al., 2002; Moran et al., 2003). Farms in the study
 466 area are likely to be smaller over the years as fathers
 467 divide their original farm among heirs—especially
 468 men—and these in turn apportion land among their
 469 respective heirs. The longer a family lives on the farm,
 470 the higher the risk of having a smaller farm due to
 471 subdivisions, and thus the higher the risk of out-
 472 migration. The results show a highly significant
 473 difference-of-means when considering out-migrants
 474 choosing urban destinations based on population
 475 density. Women moving to urban areas are much
 476 more likely to come from farms with higher pop-
 477 ulation density, while men out-migrate, on average,
 478 from farms with lower population density. The
 479 difference-of-means test is less significant when
 480 considering out-migration to rural areas or those not
 481 moving, and shows that women are more likely to
 482 out-migrate to rural areas at lower population densities
 483 compared to urban areas.

484 Two variables measure the transportation infra-
 485 structure physically linking farm households to towns
 486 and roads in the study area: *Walking distance to the*
 487 *nearest road* and *Distance to the nearest town*. Better
 488 and shorter access to towns and roads implies more
 489 possibilities of circulation and/or out-migration of
 490 household members looking for work, a marketplace,
 491 services or facilities in local towns, and facilitates
 492 communication and travel. The difference-of-means
 493 for *Distance to the nearest road* is significant only
 494 for those choosing rural destinations; male out-
 495 migration is associated with a significantly greater
 496 walking distance compared to women. It is likely that
 497 more difficult access to roads constitute a greater
 498 physical barrier for women, whose migration behav-
 499 ior is associated with shorter walking distances.
 500 Regarding *Distance to the nearest market*, men seem
 501 to be more likely to out-migrate from farm house-
 502 holds at greater distances from markets compared to
 503 women, both for rural and urban destinations, while
 504 this difference is only marginally significant when
 505 considering those not moving. This result, as well as
 506 walking distance, suggests that transportation infra-
 507 structure is likely to be a key factor constraining
 508 female's out-migration.

509 *Difference in amount of land* measures the amount
 510 of land in a farm dedicated to crops, pasture or forest

511 in 1999, compared to 1990. A negative value indicates 511
 512 that the amount (ha) of a specific land use in 1999 is, 512
 513 on average, smaller compared to the amount of land in 513
 514 1990. The fact that all but one land use, according to 514
 515 gender and out-migration destinations, have negative 515
 516 values reflects the important process of land sub- 516
 517 division in the study area during the 1990s, with farm 517
 518 households in 1999 having, on average, less land 518
 519 available for any particular use. Nonetheless, one can 519
 520 see that higher declines occurred for forests and crops, 520
 521 while a smaller decline, or even an increase, occurred 521
 522 in the amount of land in pasture, suggesting that the 522
 523 latter is an increasingly preferred land use. This 523
 524 pattern recurs in other areas of tropical forests, 524
 525 especially the Brazilian Amazon (Hecht, 1983; 525
 526 Walker et al., 2000).

527 Among out-migrants, the difference-of-means in 527
 528 amount of land in crops is significant only for those 528
 529 choosing urban areas. Crops are associated with 529
 530 family subsistence production, and women moving 530
 531 to an urban area come, when compared to men, from 531
 532 farms with a higher decline in cropland. On the other 532
 533 hand, women not moving are more likely to live in 533
 534 farms with a smaller decline in the amount of land on 534
 535 crops, compared to men.

536 The only significant difference-of-means for 536
 537 amount of land in pasture occurs for out-migrants 537
 538 choosing urban destinations, which also represents the 538
 539 only situation of increase in the amount of land 539
 540 according to gender and out-migration status. Men are 540
 541 more likely to out-migrate from farms with a higher 541
 542 increase in the amount of land on pasture, reflecting 542
 543 an association between wealth and urban migration. A 543
 544 smaller amount of land in forest seems to affect out- 544
 545 migration decisions differently between men and 545
 546 women: while men choosing rural destinations come 546
 547 from farms losing more forest, a smaller amount of 547
 548 land on forest seems to be associated with a higher 548
 549 female out-migration to urban areas compared to men. 549
 550 Men are traditionally more engaged in rural activities, 550
 551 and as possibilities for continued agricultural exten- 551
 552 sification—converting forests into agricultural land or 552
 553 pasture—dwindles due to increasing pressures on 553
 554 available land, out-migration to other rural areas in 554
 555 the Amazon is a likely consequence, while women are 555
 556 more likely to move to urban areas. However, this 556
 557 rural migration response among men occurs more 557
 558 frequently among men without pasture land, and 558

559 therefore capital, which is associated with a greater
560 socio-economic capital which would select for urban
561 migration.

562 5. Conclusions and discussion

563 This paper shows the importance of a longitudinal
564 analysis in illuminating an important, yet neglected
565 dimension of studies on land use and migration in
566 Latin America. Exploring gender differentials in out-
567 migration destinations allows a more nuanced under-
568 standing of processes engendering further deforestation
569 and increasing urbanization in the Amazon.

570 As population grows, with second or third gener-
571 ation of settlers demanding more land and new in-
572 migrants arriving to the Ecuadorian Amazon and with
573 decreasing possibilities of improving agricultural out-
574 puts through agricultural extensification, land in
575 traditional colonization areas becomes increasingly
576 scarce over the years, and out-migration becomes an
577 alternative for younger household members. This
578 paper suggests that increasing resource scarcity—as
579 indicated by higher numbers of people living in the
580 household, higher population density at the farm, and
581 decreasing amounts of land in forest and crops—is
582 associated with male out-migration to rural areas, and
583 female out-migration to urban areas. Thus, a “vicious
584 cycle” is created: Pressure over land leads to defor-
585 estation in most or all farm forest areas and reduces
586 possibilities for agricultural extensification; out-migra-
587 tion, especially male out-migration, becomes chan-
588 neled to other rural or forest areas in the Amazon (with
589 women more likely to choose urban destinations than
590 men); and, given continued population growth in the
591 newly settled areas, population pressures will engen-
592 der further out-migration and unabated deforestation
593 (Barbieri, 2003). Further exacerbating this process is
594 the fact that household size is greater among rural
595 migrants, thus creating greater population momentum.

596 Evidence of men breaking out of this rural
597 migration cycle is revealed in the data in that men
598 with increasing pasture on the farm, a proxy for
599 increased wealth status, are more likely urban
600 migrants. The socio-economic benefits accrued
601 through wealth are many, including better education
602 and different aspirations, many of which will select
603 for urban migration. This adds an important dimen-

sion to the debate on frontier land use. The much-
maligned cattle rancher, while typically clearing much
more forest than the typical crop farmer, is because of
an urban migration proclivity, perhaps less destructive
of the forest over time.

Cumulative probabilities of out-migration between
1990 and 1998 show that out-migration to rural areas
is more likely than to urban areas, but with a distinct
gendered pattern—men were more likely to out-
migrate to other rural areas between 1990 and 1998,
and women were more likely to out-migrate to urban
areas in the same period. This result suggests that
gender imbalances in motivations to out-migrate are a
key driver behind out-migration and, ultimately, forest
conversion and frontier urbanization. These processes
remain unexamined in previous empirical literatures
which focus on more aggregate and cross-sectional
analyses, and do not clarify the importance of factors
operating at the farm household level over time.

Individual, infrastructure, and demographic factors
are particularly important in female out-migration. For
example, female out-migrants are essentially selected
from younger ages, as suggested by Laurian *et al.*
(1998). Women seem more likely to move in the
absence of strong migration networks (measured by
the number of previous out-migrants in the house-
hold). Transportation infrastructure is also a partic-
ularly important factor in women’s mobility, since it
facilitates out-migration to towns for housework,
activities such as retail and informal work, or to
accompany school-age children.

On the other hand, economic and land use factors
are particularly important to understand male out-
migration. For example, pasture is a less labor-
demanding activity compared to crops, thus releasing
male labor to urban areas. Further, male out-migration
can respond to capital accumulation strategies, with
male urban employment a means to accumulate
capital to invest in cattle. Better transportation infra-
structure, including new roads, also means more
access to new settlement areas, especially for men or
married couples. Easier access to new lands in the
Amazon especially through male out-migration is
very likely to promote further deforestation; this
finding corroborates the link between deforestation
and road accessibility noted thoroughly in the
literature (e.g., Rudel, 1983; Nelson and Hellerstein,
1997).

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652 The results also suggest that some drivers of
653 gendered out-migration differentials result from wom-
654 en's marginal household bargaining power. Women
655 usually leave their homes to live elsewhere when
656 marrying or in order to marry since, among other
657 factors, they are usually less privileged in the share of
658 limited resources, having more limited access to land
659 and farm work compared to men, as suggested in
660 previous studies (Radcliffe, 1991; Lawson, 1998).
661 The association between female out-migration and a
662 smaller proportion of women engaged in on-farm
663 work (when compared to men) reflects their small
664 participation in farm household strategies regarding
665 labor allocation. Further research would benefit from
666 an understanding of how this migration pattern results
667 from specific social and cultural processes operating
668 in rural areas of the Ecuadorian Amazon.

669 Finally, the results suggest the necessity of a
670 revision in national policies regarding population
671 redistribution and its effects on urbanization and
672 deforestation in the Amazon. "Laissez-faire" or per-
673 missive policies may have proven effective for govern-
674 ment geopolitical purposes of occupying the Amazon,
675 relieving land pressures and assuaging conflicts in the
676 most densely populated areas in the country (especially
677 in the Sierra). They may also have contributed to
678 generating royalties from oil activities. However,
679 recent transformations in the frontier, with population
680 growth and redistribution engendering mounting pres-
681 sures on existing forests and on urban infrastructure,
682 demand a more active policy role. It is necessary, for
683 example, to address family planning, as a way to
684 reduce population pressure on resources, measures to
685 improve living conditions in long-settled rural areas,
686 and to improve infrastructure and labor opportunities
687 in urban areas, especially for younger women.

688 The probable implications of these policies would
689 be to reduce out-migration to areas of pristine forests
690 in the Amazon, thus sundering the "vicious cycle" of
691 deforestation on the frontier, while simultaneously
692 providing better employment opportunities and living
693 standards in urban areas, especially for younger
694 women. It will be crucial to develop a long-term
695 planning perspective to anticipate specific demands
696 for a population entering a life cycle stage in which
697 the demand for land or urban employment is higher.

698 These are among the key, under examined elements
699 to be addressed in furthering research regarding

deforestation and urbanization in the Amazon frontier. 700
Future research would fruitfully probe remaining 701
questions by comparing statistical differences not only 702
between genders but also among migration destinations 703
with longitudinal models to examine the relative 704
magnitude of various household and farm character- 705
istics relative to gendered destination choices. 706

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