NON-TRADITIONAL AGRICULTURAL EXPORTS IN HIGHLAND GUATEMALA: Understandings of Risk and Perceptions of Change

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Abstract: Through a case study of small-scale Kaqchikel Maya farmers involved in non-traditional export agriculture (NTAX) in the Central Guatemalan highlands, this article examines the tensions between the mostly positive perceptions of farmers and the negative assessments of many who study NTAX production. In a context of severe political-economic structural inequalities and potentially high social and cultural costs, quantitative household survey results demonstrate a modest decrease in concentration of land in favour of Maya smallholders; more gender-egalitarian relations of production than expected; and largely positive local perceptions of economic and social change. Qualitative analysis interprets these findings in light of Maya-affective ties to land, preferences for continuity in traditional labor organization and subsistence maize production, perceptions of risk, and the transfer of traditional marketing skills. We find that Kaqchikeles are shaping alternative modernities as they deal with new sets of political-economic and social constraints.

This article examines the socio-economic, gender, and cultural impacts of non-traditional export agriculture for Kaqchikel Maya farmers in the central Guatemalan highlands. Unlike many other agricultural export regimes, the export-oriented production of fruits and vegetables (primarily broccoli, snow peas, cauliflower, and berries) has been dominated by small-scale growers in this region for over twenty years. A number of studies have exposed the high costs—economic, environmental, and social—of non-traditional agricultural export (NTAX) production for smallholding farmers, while others have examined market imperfections and policy failures that limit the potential of small-scale production to alleviate poverty. Yet, we find that Maya farmers largely view NTAX production as a positive step toward economic advancement (one that works more to their advantage than against it) and as an opportunity to use their lands and labor in ways that preserve community and reinforce key elements of their cultural heritage.

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This article also explores the contradictions between the mostly positive perceptions of Maya farmers and the negative assessments of many who study the political economy and ecology of NTAX production in Guatemala. We also explore tensions within local perceptions, as farmers evaluate both their relatively successful production histories and current and anticipated constraints to expansion. We base our analysis on quantitative household surveys and ethnographic field work conducted in the Kaqchikel region from 1998 to 2001. The paper begins with an overview of NTAX production in Guatemala, followed by a general description of the case study communities, and of the place of NTAX production in local household economies. The following three sections present quantitative and qualitative results concerning the distributional effects of NTAX production. Results show that NTAX production has contributed to a somewhat more egalitarian distribution of land ownership and that women have shared in production decision-making and benefits to a greater degree than expected. We interpret these results in the context of Maya-affective ties to land, preferences for traditional patterns in labor organization, and the transfer of traditional gendered marketing skills. The next section presents a brief analysis of local agrochemical use, a risk to sustainability that is viewed differently by social scientists and Maya farmers. Next, we present quantitative and qualitative findings concerning the perceived economic and social changes accompanying NTAX adoption at the individual, household, and community levels. These data show that both producers and nonproducers largely view NTAX production as a positive addition to available economic strategies, while also noting perceived constraints. In our conclusion, we discuss these findings in the contexts of the social and cultural capital that support Maya success in a risky market and the broader political-economic structures that challenge Maya NTAX expansion projects and other forms of rural development.

SNOW PEA AND BROCCOLI PRODUCTION IN HIGHLAND GUATEMALA: POTENTIALS AND PITFALLS

Small-scale producers in the Kaqchikel region of highland Guatemala began growing non-traditional agricultural export crops in the mid-1970s. Starting with snow peas, cauliflower, and broccoli, and expanding in the 1990s to French beans, mini-zucchinis, berries, and other exotic crops, non-traditional production has become one of Guatemala's top export earners. Today, approximately half of all farmers in the area grow non-traditional crops.

While NTAX production has been controlled by large-scale operations in much of Latin America, Maya small landholders dominate production in the Central Guatemalan highlands. In this region, both climate

and the availability of family labor contribute to a favorable environment for the small-scale production of labor-intensive fruit and vegetable crops. Just as important, many Maya farmers embrace these new markets as potentially lucrative outlets for their productive capacity and as a means of maintaining an agrarian-centered lifestyle.

During the early years of small-scale NTAX production in Guatemala, adopters of these crops were able to increase family incomes while off-farm employment in packing plants and other operations also dramatically increased (von Braun, Hotchkiss, and Immink 1989). At the macro level, small-scale production of NTAXs contributed to rapid growth in export earnings and share of the U.S. market (Thrupp, Bergeron, and Waters 1995, 58–61). Nonetheless, a growing body of literature has documented the production and marketing constraints that challenge the potential poverty-reducing and distributional benefits of NTAX production. Liliana Goldin (1996) found a close link between upward socioeconomic mobility and the adoption of non-traditional crops in a small K'iche' Maya community. While such mobility may bring trickle-down benefits to the wider community, it often accelerates class differentiation in a way that threatens traditional social cohesion. Other studies similarly concluded that the benefits of non-traditional production were likely to be concentrated in a small echelon of local landholding elites, and that NTAX production threatened subsistence bases while increasing socioeconomic inequality (Goldin and Saenz 1993; Lee 1993; AVANCSO 1994, Carletto 1996). Benefits of NTAX production may be distributed unevenly within households as well as among households. Some analysts have found that male-biased NTAX market structures threatened to deepen gender inequalities within producing households as women's unpaid agricultural labor increased while men retained control of household agricultural production and enjoyed membership in cooperatives and related organizations (von Braun, Hotchkiss, and Immink 1989; Katz 1995). Contracting with exporters has been viewed as a threat to the cultural traditions and effective independence of small-scale producers, as production practices may be dictated by exporters (Green 1998).

Access to capital and exposure to risks are key problems facing small-scale agriculturalists (Barham, Carter, and Sigelko 1995; Immink and Alarcon 1993; von Braun, Hotchkiss, and Immink 1989). In contrast to large-scale producers who plant up to 100 percent of their land with NTAXs, farmers with less than four hectares are likely to plant only around one-third hectare with these crops (Barham, Carter, and Sigelko 1995). Such small-scale producers are constrained by the lack of production credit and the need to self-insure against stochastic shocks such as catastrophic crop losses and price drops. They do this by diversifying their crop mix to include less-remunerative crops destined for domestic and other Central American markets and by growing basic foodstuffs

(von Braun, Hotchkiss and Immink 1989; Immink and Alarcon 1993). The expected return on these crops is only a fraction of the value of NTAX production, but the market outlets are more stable and familiar.

The most serious constraints arise from a highly unequal distribution of land (documented by the most recent [1979] Agricultural Census [INE 1983]). A mere 2 percent of the population controls 65 percent of arable lands; Guatemala's land distribution Gini coefficient, a measure that ranges from 0 in hypothetical situations of perfect equality to 1 in cases of perfect inequality, is 0.85 (Carter, Barham, and Mesbah 1996, 52). In some areas, farmers with very little land have achieved sufficiently high incomes per area planted with NTAX crops to permit the purchase of additional land from larger-scale producers (Carter, Barham, and Mesbah 1996; Carletto, de Janvry and Sadoulet 1999). However, soil depletion—associated with rising land pressure in imperfect markets and with high levels of agrochemical use—limits the potential for growth in NTAX production and incomes (Carletto, de Janvry, and Sadoulet 1999; see World Bank 1995, 25 on political land market imperfections). The overuse and misuse of pesticides has resulted in decreasing crop yields and product quality and U.S. rejections of produce contaminated with pesticide residues (Thrupp, Bergeron, and Waters 1995). The potential for long-term growth in the small-scale NTAX sector is also threatened by increasing price uncertainty in maturing niche markets for some crops, and by the uneven distribution of information and technology that enable producers and their marketing arms to avoid product rejections.

Altogether, these political, economic, environmental, and social constraints pose formidable challenges to small-scale NTAX producers and to the role of NTAXs in rural economic development and poverty alleviation. It is not surprising that most analysts, who focus on structural inequalities and market risks, tend to view small-scale production of non-traditional export crops as having little potential for broadly sustainable development.

SURVEY RESEARCH COMMUNITIES

Xenimajuyú (population 1,151) and Xeabaj (population 917) are predominately Kaqchikel Maya communities located on or near the Pan American Highway in the municipalities of Tecpán and Santa Apolonia. Non-traditional crops were first adopted in Xenimajuyú in the early 1980s and in Xeabaj in the late 1980s. Quantitative analysis is based on a 1998 probabilistic-sample survey of 141 households and a follow-up 2001 survey of 214 men and women from a randomized subsample of 113 households. Ninety-four percent of the sampled population self-identified as Kaqchikel Mayan were nearly all bilingual in Kaqchikel and Spanish. Households were divided fairly evenly between Roman Catholic

and Protestant affiliations. Two-thirds of households were comprised of nuclear families; 9 percent were headed by single women. Our statistical analysis of survey results is contextualized with qualitative ethnographic data based on interviews and observations carried out in Xenimajuyú, Xeabaj, and neighboring communities from 1998 to 2001.[1]

The local economy is agriculturally-based. In 1998 over 80 percent of male household heads reported household agriculture as their primary occupation and half of all households included members who earned wages as agricultural laborers. Two-thirds of households sold animals during the year of the survey and 7 percent ran agricultural wholesale businesses. Nonagricultural income sources included services, textile and earthenware artisanry, and storekeeping. Of the 95 percent of households that planted crops, around one-third planted only maize and other crops for household consumption. Half of all farmers (sixty-six) planted non-traditional export crops, primarily snow peas and broccoli. An additional twenty-three farmers planted crops such as potatoes, strawberries, and cabbage and marketed in domestic and other Central American markets; many NTAX producers also planted these crops. The 2001 survey showed that, during the production cycles that began in July 2000, seventy-two households (64 percent of the total sample) planted snow peas and fifteen (13 percent) planted broccoli. The increase in proportion of NTAX producers between 1998 and 2001 reflects the entry of first-time producers into the market. NTAX producers were younger and more likely to be Protestant than others in the communities; education levels did not differ between producers and nonproducers. Most NTAX producers planted less than one-fourth hectare with non-traditional crops, devoting their other lands to subsistence and additional market production.

Non-traditional export production provided considerable employment in Xenimajuyú and Xeabaj. In 2001, 69 percent of survey respondents said that at least one person in their families had worked in

1. Research was carried out under the auspices of the Integrated Pest Management Collaborative Research Support Program, funded by the U.S. Agency for International Development (agreement no. LAG-4196-G-00-5001-00 and grant no. LAG-G-00-93-00053-00). This paper does not necessarily reflect the views of the agency. Survey design and data collection were carried out by Estudio 1360, directed by Linda Asturias de Barrios, in consultation with Hamilton and Liliana Goldin (Asturias et al. 1999). We would like to acknowledge the fine work of Dr. Asturias de Barrios and Estudio 1360 members Brenda Tevalán, Luisa María Mazariegos, Cecilia Skinner-Klee, Flor Mencos, Mónica Berger, and Hugo Alfaro. Lic. Berger and Lic. Alfaro also conducted qualitative field research. Qualitative research was further funded by grants to Fischer from the John D. and Catherine T. MacArthur Foundation and the Wenner-Gren Foundation for Anthropological Research; Christopher Jones and Peter Benson provided invaluable assistance with this work.

Table 1 Non-traditional Agricultural Export Production as a Function of the Amount of Land Controlled by Households[a], Xenimajuyú and Xeabaj, Chimaltenango

	Hectares Controlled by Households, in quartiles				*Sample*
	.03–.49	*.5–.99*	*1–2.49*	*2.5–32.6*	
	(N=50)	*(N=43)*	*(N=29)*	*(N=12)*	*(N=134)*
Percentage planting NTAXs[b]	30%	61%	55%	75%	49%
	Analysis of variance[c] in hectares planted to NTAX by 66 producers (subsample), across landholding quartiles				
Mean no. of hectares in NTAXs	.14	.14	.29	1.0	.29
Standard deviation	.07	.05	.20	1.4	.59
Minimum	.06	.06	.08	.23	.06
Maximum	.39	.23	.68	4.74	4.74

Source: *Household Surveys*, 1998

a. Land owned plus land rented in, minus land rented out.

b. The proportion of households planting NTAXs increases significantly as the amount of land increases across quartiles of landholding size. Gamma=.416; p=.001.

c. The analysis of variance does reveal some significant differences in the average number of hectares planted to NTAXs by households across quartiles of landholding size (F=7.005; p=.007). However, the differences are statistically significant only between those households with >2.5 ha. (the top quartile) and those with < 2.5 ha. (all other households).

household NTAX production during the previous five years. On average, 3.5 family members had worked in NTAX production in these families. During the same time period, wage work in the NTAX fields provided employment for 57 percent of families and a total of 252 individuals. Local growers employed an average of five temporary laborers for snow pea and broccoli production. The largest-scale snow-pea operation employed forty laborers. Non-farm work related to NTAXs also provided employment for a few families. Nine percent of household heads had worked in packing plants or in the commercialization or transportation of NTAXs. Seventeen individuals had worked in packing plants; fifteen in NTAX-based commerce; and twelve in transportation.

Access to agricultural infrastructure is limited in these communities. Although many Guatemalan smallholders produce and market non-traditional export crops through cooperatives, the local market was dominated by private intermediaries ("coyotes") and contract production with agroexporters. Only 12 percent of male household heads and 3 percent of

female heads belonged to cooperative groups with established links to agroexporters. Among snow pea producers, more than three-fourths sold to intermediaries; among broccoli producers, nearly three-fourths sold to an exporter, with the remainder selling to intermediaries. Our surveys found that with snow peas, where price differentials among marketing outlets were greatest, producers who sold through exporters made one-third more than those who sold to intermediaries.

DISTRIBUTION OF NTAX ADOPTION, LAND, AND EXPANSION CONSTRAINTS

The potential for small-scale NTAX production to alleviate poverty and enable widespread social mobility depends on broadly-based access to the means of production. Mirroring the national pattern, the local distribution of land among households was highly and positively skewed. On average, households owned slightly less than one-half hectare. One-fifth of households did not own land; an additional three-fifths owned less than a hectare; and only 3 percent owned five or more hectares. Although half of the agricultural households rented land for production, when the total amount of land available (including rental land) is considered, households at the median accessed only 0.62 hectares. While only 4 percent did not access any land, the proportion with 5 or more hectares was reduced by only 1 percent through rental. One-third rented land for NTAX production, the same proportion that rented land for other crops (some households rented for both production regimes), while only 9 percent rented out land to NTAX producers. Only 30 percent of households accessed irrigated land.

Based on survey reporting of land accessed by households and planted with NTAX crops in the 1997–98 production cycle, we statistically tested whether there is a threshold below which a household cannot or will not produce NTAXs and whether controlling relatively larger amounts of land correlates with planting larger amounts of land to NTAXs. As these data are cross-sectional, significant associations may reflect (*a*) the amount of land a household must have before it is considered potentially advantageous to plant NTAXs or (*b*) accumulation derived (at least in part) from past production of these high-value crops.

Table 1 presents these data, which show that although the proportion of households planting NTAXs increases significantly along with greater access to land, the amounts planted to NTAXs differ significantly only among those with the largest amounts of land (the quartile holding 2.5 ha. or more) and all other producers. Only one producer planted more than one hectare. No one in the sample devoted more than one half of household land to NTAX crops, and most planted less than one fourth of their land with these crops.

These data show that most households with less than 0.5 hectares either were unable to produce NTAXs or decided that it was not in their best interest to invest their land, labor, and cash in such production. Even for those with more land, production of NTAXs was clearly only one part of a diversified portfolio of household agricultural activities. The benefits of producing higher-value export crops are likely to sustain only a modestly positive economic growth trajectory for most households unless production contributes to the purchase or rental of additional land so that more producers control the 2.5 hectares currently necessary for self-insurers to expand production.

A lively land market exists in the area, fueled in part by NTAX production and demonstrating a very modest trend toward deconcentration. Thirty-seven percent (N=78) of the 2001 sample reported buying land since NTAXs were introduced in their communities. Half of these individuals used receipts from NTAX production for land purchase. Of the thirty-nine individuals who reported having sold "a little" of their land during this time period, seven said that NTAX marketing losses contributed to their decision to sell to NTAX marketing losses. However, most of these individuals continued to produce NTAXs and reported an overall improvement in their standard of living following the introduction of NTAX production. The only people who reported selling a large proportion of their land were a ladino couple who, following their NTAX-related loss, still owned by far the largest holding in the sample.

A Maya farmer's view of small-scale competitive advantage is attributed to distributional changes favoring small-scale operations:

> Here there are no medium-size producers, only small ones and big ones. Small producers have benefited most from these new crops, and now they are buying more land. And then there are people who don't grow these crops, but they still reap benefits from the business, working to harvest, pack, and transport the product.

As this man suggests, given the relatively high return for household labor and input investment in NTAXs and the scarcity of remunerative non-farm employment, non-traditionals appear to offer smallholders in these communities their best current chance at increasing accumulation. When current and past producers were asked to identify constraints to increasing their income through NTAX production, most said that their most pressing needs were production credit, additional land and/or irrigated land, and better access to markets. Even during a year of low prices, farmers emphasized production factors and market access over better prices, and many wanted to increase production. However, producers remain committed to a diversified production portfolio precisely because they cannot afford to take the risks associated with planting more of their land with NTAXs, and also because, for cultural as well as

economic reasons, they prefer to provide their households with home-produced maize.

ECONOMIC CHOICES AND AFFECTIVE TIES OF LAND

For most Kaqchikel farmers in the study communities, relationships with the land and its produce go well beyond strict economic rationality. Land—the most important productive material asset for a farmer—is also enmeshed in webs of relations from kinship ties and family histories to personal narratives and individual desires. In economic terms, such factors "distort" free markets; from a local perspective they are the symbolic foundation of the market itself.

Ethnographers have long noted Maya peoples' attachment to the land, a trait broadly shared among farming and peasant peoples the world over. For traditionalist Maya, such beliefs are represented in religious rituals, a primary function of which is to feed the earth and its lords (*ru k'u'x kaj, ruk'u'x ulew*, "the heart of sky, the heart of earth") so as to continue the momentum of cyclic regeneration and renewal. In this light, land is often attributed with agency, a view heard in phrasings such as "the land gives," "the earth is angry," and "the fields require."

Yet, it is not only "traditionalist" Maya who hold such beliefs, for devout Roman Catholics and staunch Protestants also assign special value to the land. Kaqchikel farmers often explain different sorts of attachment to the land—not through religious difference, but by ethnic distinctions. As one middle-aged woman explained:

> For *kawinäq* [Maya people] it is very painful to sell a piece of land, especially if it was given by their parents. For *kaxlanes* [non-indigenous people] this is not true. Even if his land was given to him by his father, the *kaxlan* will sell it and invest the money in some business to get ahead. Even his father won't be upset because their *ranima* ["soul"] is that way—they only care about their own self-interests.

Such a perspective sees *kaxlan* attitudes as generally more economically rational (thus accounting for ladinos' greater material success) and more cavalier in terms of affective relations (which is to say, approximating the socially alienating ideal of capitalist relations). It also points to the fact that agricultural production (traditional and non-traditional alike) meshes in many ways with established Kaqchikel patterns of social and cultural life. One man opined that "the Maya way of teaching goes with communal work. . . . This is true with broccoli just as it is with maize." Such sentiments were echoed by many of the Maya farmers interviewed. NTAX production is risky, it was acknowledged, but it is also largely seen as the best hope for holding onto family lands and the traditions that surround them in rapidly changing (but always trying) economic times.

GENDER AND THE INTRAHOUSEHOLD DISTRIBUTION OF NTAX RESOURCES

In the central Guatemalan highlands, land ownership and the management of production and consumption budgets are strongly differentiated by gender. Traditionally, women earned incomes through craft production, storekeeping, small animal production, and selling both agricultural and nonagricultural products in regional markets, while men were primarily responsible for crop production. Women managed the household subsistence and budget, while men managed the budget for crop production. Earlier studies concluded that the household's adoption of NTAXs resulted in increased field labor for women, who could be forced to decrease the amount of time devoted to independent income-producing activities (von Braun, Hotchkiss, and Immink 1989; Blumberg 1994). Rae Blumberg found that women's loss of independent income resulted in decreased intrahousehold economic leverage (1994). Since producer cooperatives and export contracting tended to be dominated by men, while women were responsible for stretching household subsistence funds to cover food and many other domestic expenditures, women depended on their spouses to share receipts in a manner that would compensate for any decrease in their own independent incomes. One study found that, although women did not give up independent income-earning activities while working in the NTAX fields, they received a smaller proportion of incremental income derived from NTAX production than did women whose households' income increments were from other sources (Katz 1995).

In our sample, we found women heavily involved in household production of NTAXs and other commercial crops. Among commercial producers, 94 percent of women performed some work associated with household production. Women were most likely to work in planting and harvesting both NTAXs and internally marketed crops, with 25 percent also involved in cultivation and 10 percent in land preparation. Women also marketed crops in many households, and women were considered the primary producers of income derived from nonbulk marketing of household crops (i.e., crops sold in regional markets rather than to exporters and other bulk buyers) in 16 percent of all households. Women's primary control of nonbulk marketing provided independent income and yielded higher prices than bulk sales (Hamilton, Asturias de Barrios, and Tevalán 2001). Few female household heads earned off-farm agricultural wages, and agricultural processing was more likely to employ young, unmarried females. Women's other sources of income included animal production, storekeeping, and other petty commerce; a few women sold agricultural produce in bulk or worked as agricultural market intermediaries.

Elsewhere we have shown that women in local NTAX-producing households were not marginalized from independent income-producing

work relative to women whose households did not produce NTAXs and that the likelihood of independent income from animal production increased with the amount of NTAX-planted land (Hamilton, Asturias de Barrios, and Tevalán 2001). Women and men reported women's primary or shared control of NTAX earnings in over 66 percent of producing households in 1998 and in 2001. We did not elicit information on the proportion of this income under women's exclusive control or the meanings of shared control. However, the positive perceptions of women regarding their ability to use NTAX earnings to provision their families with food and other subsistence goods (reported below) lead us to conclude that women were not marginalized from control of NTAX earnings.[2]

Perhaps the most surprising finding regarding the effect of NTAX production on the gendered control of household economic resources is the extraordinary degree to which both women and men reported women's participation in land-use decisions in NTAX-producing households. Gendered inheritance practices and land control vary widely among highland Maya peoples (Hill and Gollas 1968; Gross and Kendall 1983; Bossen 1984, 86–92; Fundación Arias/Tierra Viva 1993; Asturias de Barrios et al. 1999; Deere and León 1999). However, Kaqchikel populations in the study region have been characterized as patriarchal with respect to landholding and land-use decision-making, even on women's land (Katz 1995, Nieves 1987). In our sample, only 22 percent of women had inherited or bought land individually—compared with 57 percent of men—while another 29 percent had bought land together with their husbands. Yet three-fourths of NTAX producers reported that land-use decisions were made jointly between male and female household heads or, in a few cases, independently by women; the proportions were identical for male and female informants, who were interviewed separately. We did not attempt to measure the quality of women's participation in land-use decisions, which can range from pro forma consultation to genuinely shared control. Nonetheless, the fact that so many women participate in the family's most important production decision indicates that women have more of a voice in NTAX adoption and the extent to which a family will devote its resources to NTAX production than earlier studies suggested.

2. In a 1994 study of a Kaqchikel community near Guatemala City, Linda Asturias de Barrios et al. found that women in NTAX-producing households directly controlled 58 percent of all incomes; in households that derived all of their income from agriculture, women and men each controlled half of the income. Although many households were affiliated with a male-oriented production and marketing cooperative, women delivered to the co-op or marketed snow peas in 40 percent of producing households and French beans in 60 percent of producing households (Asturias de Barrios, Mazariegos, Tevalán, and Rubio 1996).

All women who own land, and many others, made land-use decisions. Multiple regression analysis was designed to help explain women's control of land use by testing the independent effects of women's agricultural field labor involvement, marketing of household production, independent ownership of land, joint ownership of land, social status as single female household head, and amount of land planted to NTAXs. Women's independent ownership of land and women's work in nonbulk marketing of agricultural products proved to be significant predictors of women's land-use decision-making.[3] It was not necessary for women to be single household heads in order to have land-use decision input. By the same token, joint ownership of land does not necessarily imply joint decision processes.[4]

The contribution of women's agricultural marketing (but not women's field labor) to land-use decision-making may derive from both material and ideological factors. Both men and women generally perceive that men are primarily responsible for the production of most crops, while women are primarily responsible for animal production and some agricultural marketing. In a study from the western Guatemalan highlands, Laurel Bossen found that contributing specialized skills was more likely to result in identifying a person as a primary producer (1984, 128). Rae Blumberg found that, in the Central highlands, women's cash-producing agricultural marketing was associated with greater access to economic decision processes, while unpaid field labor in family NTAX fields was not (1994). Our results are consistent with both earlier studies.

It appears that the inheritance of land and the agricultural marketing niches that women have carved out—relying on traditional marketing experience and freedom of movement—provide entrée to decision processes for the minority of women who inherit land or are perceived to be the household's primary nonbulk marketers. Since many more women are participating in land-use decisions, these factors obviously do not explain decision entrée for the entire sample. Nor are we able to account

3. Logistic regression is a multivariate technique for directly estimating the probability of an event occurring (Norusis 1990, 119–48). It is an appropriate test for models in which the dependent variable is a binary qualitative measure (Handwerker and Borgatti 1998, 586). For the model we tested, the model chi square is 13.403 (-2LL decreased from 89.818 to 76.415); the significance level for the model is .001. The change in –2LL attributable to women's agricultural marketing is 7.961 (significance level = .005) and the effect of women's independent land ownership is 5.442 (significance level = .020). (The model also generated an R^2 of .225; no significance level was computed for the R^2.) Additional tests controlling for women's land ownership found that women who did not own land were more likely to make land use decisions if they marketed agricultural products (Gamma = 1; p = .004). For further details, see "Methodological Note" at the end of this text.

4. In a separate test sampling only indigenous households, joint ownership of land was positively associated with women's land use decision-making.

for differences between our findings and those of Elizabeth Katz, whose extensive and excellent work in the study region was based on data collected from 1990 to 1991. Katz reported that 60 percent of single female household heads made land-use decisions (out of the 80 percent of single female heads who held land independently), while only 30 percent of married women made such decisions. Although this figure was nearly identical to the proportion of married women who owned land and although land-use patterns did not differ on the lands of single and married women, Katz reported that married women owners had much less control of their lands than single women (1995). Our research communities are broadly comparable to those Katz surveyed; the survey instruments asked identical questions regarding land-use decision-making in the two studies. It is possible that our research communities are unusual in the degree to which women participate in making decisions regarding land use. It is also possible that change over time accounts for some of the difference between our study and the earlier one, as more households have adopted NTAXs. In our 2001 sample, which showed increasing adoption since 1998, NTAX production did correlate positively and significantly with women's participation in land-use decision-making,[5] in comparison with the positive but insignificant result in 1998.

AGROCHEMICALS AND SUSTAINABILITY

Misuse of agrochemicals has serious economic, environmental, and human health costs for NTAX farmers (Thrupp, Bergeron, and Waters 1995; Arbona 1998; Murray and Taylor 2000). Although alternative pest management techniques for snow peas have been shown to lower producer costs while improving yields and product quality in the study area (Solóranzo and Chinchilla 1998; Julian, Sullivan, and Sánchez 2000), this information has limited circulation. Alternative approaches may appear risky to farmers, following decades of agrochemical promotion by exporters, the chemical industry, and agricultural scientists and extensionists (Hamilton 1998; Hamilton and Tanzo 1998). While local farmers often discussed problems of "wearing out the soil" through agrochemical use and the necessity to diversify production, they were more aware of damage caused by pests and the cosmetic requirements of buyers than of the losses agroexporters suffer (and pass along to growers) from pesticide contamination.

In the study communities modest gains have been made in reducing the reliance on chemical pesticides; more progress has been made in eliminating the use of the most toxic chemicals and adding nonchemical

5. Gamma = .358, p = .013.

forms of pest management. Most NTAX producers said that they practice crop rotation, consult with technicians before fumigation about product choice and application procedures, change pesticides to avoid increasing pest tolerance, and search out the registration status of pesticides to avoid the most harmful chemicals. About 40 percent reported ever scouting pest populations before deciding to fumigate, one-third used insect traps, and one-fourth had used biological controls. However, with the exception of biological controls, these practices did not significantly influence the number of insecticide applications farmers reported for snow peas, averaging seventeen for the most recent growing cycle in 2001. In accounting for the number of insecticide sprays, farmers cited the recommendations of the primary agroexporter operating in the region (twenty applications per cycle) even though most growers did not market crops under contract. This level, while high, represents a decrease from the thirty sprays recommended in the company's producer protocols for 1990, a level established before widespread crop detentions resulted from pesticide residues in the mid-1990s. Although most applications were of insecticides, fungicides were also routinely applied in the rainy season.

Only approximately 40 percent of local NTAX farmers had access to pest management extension services of any sort (through agroexporters, private extension services, or a local alternative development agency), and most of these offerings were limited to a single field day. Thus, the proportion who were willing to experiment with alternative practices suggests that farmers are willing to diversify pest management strategies, if not to substitute alternatives for chemical pesticides. Those self-organized farmers with the most sustained access to local alternative pest-management experimentation (around 10 percent) were most likely to incorporate multiple alternative practices, including biologicals, and to reduce the number of applications to around seven per cycle. However, most local farmers relied on restricting the proportion of land devoted to NTAX production and crop rotation to reduce economic and environmental risks rather than decreasing substantially the use of agrochemicals. Their notion of "sustainability" appeared to be based on economically sustaining their families and caring for their land by diversifying production—with a minority also willing to diversify pest management practices—rather than on risking a largely nonchemical crop management strategy.

LOCAL PERCEPTIONS OF ECONOMIC AND SOCIAL CHANGE

In 1998 survey respondents were asked if people were better or worse economically than before NTAXs were locally produced. Sixty percent believed that people were doing better; 24 percent perceived no

Table 2 Perception of Family Economic Trajectory Following the Introduction of Non-traditional Export Crops into Community, Xenimajuyú and Xeabaj, Chimaltenango

Economic situation is:	*N*	*%*
Much better	14	6.6%
Better	107	50.7%
The same	77	36.5%
Worse	9	4.3%
Much worse	4	1.9%
Total	211	100%

Source: *Household Surveys*, 2001

economic change; and 16 percent felt that people were worse off. When respondents were asked to evaluate overall change in their communities, even more responded positively. Eighty-one percent concluded that, in general, change had been positive. Only 3 percent said there had been no change, and 16 percent said change had been negative. There were no statistical differences on measures of economic or general change between NTAX producers and nonproducers, among households according to strata of landholding, or by the number of hectares planted by households.[6]

Our 2001 survey was designed to measure more precisely local perceptions of the long-term social and economic effects of NTAX production at the household and community levels and to collect production histories. All respondents answered a global question concerning the economic trajectory of their families over the past fifteen to twenty years, the period of time during which non-traditional crops have been grown in the two communities. As shown in table 2, 57 percent of people felt they were better off than before non-traditionals came to the community, while only 6 percent felt they had lost ground since NTAXs arrived. A sizeable minority (37 percent) felt their economic situation had not changed.

Subsamples of current and former producers of NTAXs were asked to evaluate change in their families' fortunes during the entire period they had produced the crops. As they looked back over their production histories, 57 percent of current NTAX producers felt that their families' economic situation had improved. Most of the remainder felt that there had been little change, a result that may have been influenced by the relatively short time span of production for some families. Only 7

6. For a parallel discussion of economic ideology and NTAX production based on this household survey, see Goldin and Asturias, 2001.

percent felt their economic situation had worsened. (These figures tallied with current producers' perceptions of family economic change on the global measure of change since NTAX adoption in the communities.) Even among individuals who no longer produced NTAXs (*N*=20), the majority felt they were better off (35 percent) or the same (45 percent) as before they began to produce these crops. (On the global measure, former producers reported a more positive picture: 65 percent reported they were better off than before NTAXs came to the communities; 30 percent said their economic situation had not changed. Most former producers abandoned production because they had largely retired from farming as their families matured and children began producing on their own or moved away.) In response to questions about the viability of individual crops, three-fourths of current and former snow pea and broccoli producers reported that these crops provided a good livelihood.

Respondents also provided information concerning perceived changes in quality of life, including education and nutrition. Changes were perceived as overwhelmingly positive. Ninety-four percent said that more children complete higher levels of education than before non-traditional export crops came to the community, and 68 percent of NTAX producers had used money from production to pay for their children's education. The same proportion reporting using NTAX funds for sons' education as reported this investment for daughters. Following the work of Elizabeth Katz (1995), who demonstrated that women's work in the NTAX fields often resulted in daughters doing additional housework, we tested for gender differences in school attendance within NTAX-producing families. Gender differences in the perceived level of regular school attendance for children in families that produced NTAX crops were absent. In one-third of NTAX-producing families, parents said that both their girls and boys attended school more regularly than before the family produced NTAXs, while only 4 percent said the children attended school less often.

Among women, positive changes in family nutrition and health care were reported. Nearly two-thirds of women reported improved diets for their families, and 85 percent of women in NTAX-producing households said that money from NTAXs had helped them to improve the family diet. In NTAX-producing households, three-fourths of women said that their families produced an equal or greater amount of maize per household requirement than before they began to produce for export. However, the minority who reported producing less maize also said they were unable to obtain the remainder of their household maize requirement. Over one-third of women in NTAX-producing households said they were able to provision their families with more meat than before they began export production, with nearly 58 percent reporting no

Economic situation is:

change. While these results are mixed, the direction of change was perceived to be positive or neutral for the majority of women on all measures, and NTAX proceeds were found to contribute to positive change.

When women were asked if they wanted their families to continue producing NTAXs, 95 percent answered positively. When asked why, virtually all responded that NTAXs offered the most lucrative and/or most stable form of income generation available to them. This finding speaks to the lack of alternative forms of income generation as well as to the relative status of NTAXs as a positively-perceived source of income. However, it also suggests that women did not consider that they and their children had been left out of the benefit stream. When testing whether the degree of her family's involvement in NTAX production affected a woman's perception of family economic change relative to the introduction of NTAXs in her community, we found no statistically significant differences among women whose families were current producers, former producers, or had never produced the crops (table 3). In households of current and former NTAX producers, there were no differences between women and men concerning the degree to which they perceived family economic change to be positive or negative following the household adoption of non-traditionals.[7]

The results of the 2001 survey show that, in the community as a whole, NTAX production was generally associated with an improved or stable family economic situation and quality of life. In short, NTAX production was perceived as a good way to make a living: current producers considered themselves to be better off economically than before they began NTAX production; NTAX production provided considerable employment in the community; and most producers indicated that, if they had greater liquidity and a larger land base, they could produce more than their current output.

This picture should not belie the complexity of farmer perceptions toward NTAX production. Despite having maintained their share of the market for as long as twenty years, farmers worried about the future. With land prices rising and more large-scale operations entering the snow pea market, the continued viability of small plots was a concern, especially to those farmers who were not affiliated with production or marketing organizations. The rapid increase in production, as more independent producers entered the market and large-scale operations increased volume, was expected to exert downward pressure on prices.

7. T- test for equality of means was used. Family economic trajectory was rated on a 5 point scale, with value of 5 for much better than before NTAX were produced to value of 1 for much worse than before NTAXs were produced. For 79 men: mean, 3.56; Std. Deviation, .813; Std. Error (mean), .091. For 75 women: mean, 3.63; Std. Deviation, .653; Std. Error (mean), .075. T = .588; two-tailed significance of t = .557.

Table 3 Perceived Family Economic Trajectory following the Introduction of Non-traditional Export Crops into the Community by Degree of Involvement in NTAX Production, by Gender (Xenimajuyú and Xeabaj, Chimaltenango)

	Never Produced		*Former Producer*		*Current Producer*		*Totals, by Gender*	
	N	%	*N*	%	*N*	%	*N*	%
Men[a]								
Much worse (value=1)	1	4.2	0	0	2	2.9	3	2.9
Worse (value=2)			1	9.1	4	5.8	5	4.9
About the same (value=3)	11	45.8	2	18.2	22	32.4	35	34
Better (value=4)	11	45.8	8	72.7	35	51.5	54	52.4
Much better (value=5)	1	4.2	0	0	5	7.4	6	5.8
Totals	24	100	11	100	68	100	103	100
Women[b]								
Much worse (value=1)	1	3.0	0	0	0	0	1	.9
Worse (value=2)	3	9.1	0	0	1	1.5	4	3.7
About the same (value=3)	10	30.3	4	44.4	28	42.4	42	38.9
Better (value=4)	17	51.5	3	33.3	33	50.0	53	49.1
Much better (value=5)	2	6.1	2	22.2	4	6.1	8	7.4
Totals	33	100	9	100	66	100	108	100

Source: *Household Surveys*, 2001

a. Differences across degrees of involvement in NTAX production are not statistically significant (Gamma=.071; p=.664).
b. Differences across degrees of involvement in NTAX production are not statistically significant (Gamma=.029; p=.854).

Farmers who could not manage to meet U.S. market quality standards were more likely to sell to middlemen consolidators, a process that threatens the advantages reaped through disintermediation.

Consider the case of a relatively successful Maya farmer, Serapio, who farmed traditional milpa (maize and beans) as well as French beans, snow peas, and blackberries on the several hectares of land owned with his brothers. With earnings from export crops, he was able to buy a pick-up truck to haul his produce directly to packing plants and a cell phone to check on prices. From his perspective, quality control was one of the most pressing problems: "I believe that technically we have some problems. We are not trained to produce a quality product, but now we're working to produce better quality products." A neighbor agreed: "quality control is not part of the Maya mentality; we have to learn what the gringos want." Export packers have notoriously high standards for the appearance of products, with the slightest blemish providing grounds for rejection of contracted produce. While local farmers are learning to meet appearance,

sanitary, and phytosanitary quality standards, it is a slow process of diffusion for those not affiliated with production and marketing organizations. Farmers, too, have failed to honor production contracts (generally when prices changed drastically before the production cycle was completed), thus contributing to the uncertainty of future marketing.

CONCLUSION: SOCIO-CULTURAL ASSETS AND CONSTRAINTS TO EXPANSION IN THE SMALL-SCALE EXPORT SECTOR

Small-scale NTAX producers in the region under study are holding their own in the non-traditional export market, but also find themselves limited to slow and incremental increases in capital accumulation. Social scientists and local producers identify similar economic constraints—key among them the need for more land, scarce and expensive credit, lack of crop and loan insurance, price fluctuations, product rejection, and marketing bottlenecks. Environmental constraints resulting from the overuse of agrochemicals are also perceived in both cultural logics, though the nature of perceived risks and preferred responses differs. Nevertheless Maya farmers largely view the process of market integration in a more positive light than external analysts. In part farmers find that they are better off in many ways than before they entered the market and evaluate the process in the context of the severely limited economic options currently available to them. The ability to maintain control of their land and to use their productive capacity in ways that support cultural continuity are also considered critical components of personhood and livelihood, understood as "making a living and making it meaningful" (Bebbington 2000).

Small-scale producers in the region continue to control the means of production for export agriculture. The comparison of our results with earlier studies in the region indicates that the distribution of landholdings has changed little in the past ten years—with changes tending to favor small-scale farmers—and that the proportion of the population engaged in NTAX production has remained relatively high. In contrast with other export production regimes in Central America, larger operations have not forced small-scale producers out of the market or off their small farms. Despite a formidable array of production and marketing constraints, small-scale growers believe that NTAX production is a viable means of achieving maximum value per land area. Yet farmers do not plant most of their land with NTAXs. Productivity constraints arising from limited access to affordable credit and the need to self-insure against catastrophic losses discourage expansion. Product quality constraints lead farmers to produce other crops for internal and Central American markets, where food safety is relatively unregulated and even contaminated products can be sold, albeit at lower prices. A more

positive observation is that most NTAX producers continue to produce traditional milpa crops for household consumption. Fears that NTAX production on small holdings would crowd out traditional production—which holds cultural as well as nutritional value—have not proved to be well grounded.

In our research, both interhousehold and intrahousehold distributions of NTAX benefits proved more egalitarian than anticipated. Both household production returns and NTAX-related wage returns were widely distributed. NTAX production contributed to a very modest decrease in land concentration; land transfers from the local ladino elite to Maya farmers in the case study communities were consistent with those observed in surrounding communities (Fischer 2001). Women were found to control land and other economic resources to a surprising degree in NTAX-producing households, despite continuity with the perceived traditional division of labor (in which men were primarily responsible for agricultural production) and despite men's greater structural access to NTAX markets. The social impacts of NTAX production in the case study communities were largely perceived as positive by both producers and non-producers.

These results lead us to conclude that small-scale producers are possessed of important assets that can counter constraints to sustainable production and social displacements. These assets include family labor, parallel marketing experience outside the NTAX sector, high levels of social capital,[8] and indigenous knowledge of integrated pest management (Chinchilla 1998). Families subsidize the marginal cost of their collective labor through subsistence production, and the anticipated inverse relationship between plot size and productivity has generally held. However, the family labor asset is a mixed blessing. The availability of low opportunity-cost family labor and the requirement of many NTAX crops for high field and supervisory labor inputs figured centrally in most early calculations of the potential comparative advantage for small-scale producers, as well as in social critiques concerning the exploitation of that labor. We have shown that family members are unlikely to forego alternative income opportunities or schooling to work in household production. And the presence of local NTAX employment opportunities

8. Here we call on both Bourdieu's (1977, 1984) conceptions of cultural and social capital and Putnam's (1993, 1995) elaboration of the social capital concept. These terms capture the idea that mutually constitutive social bonds, societal norms, and culturally-shared values and meanings can provide a basis for producing collective economic, social, and political goods. Norms of trust and reciprocity, and the cultural ideational bases that enable their transference, tend to characterize those social networks analytically perceived to have greater social capital assets (Coleman 1988, 1990; Evans 1996a, 1996b; Bebbington and Perreault 1999; Fox 1996; Fox and Gershman 2000; Uphoff and Wijayaratna 2000; Petro 2001; Pretty and Ward 2001).

certainly offers a positive alternative to deployment of "unskilled labor" to exploitative wage labor on distant plantations (Fischer 2001). However, the low opportunity cost of family labor also reflects the relatively low levels of education and of well-paying non-agricultural employment in the micro-region.

Our research suggests that indigenous women and men have been able to leverage marketing experience in the textile and regional agricultural markets to maintain control of their means of production while participating in global markets (Hamilton et al. 2000; Fischer 2001). Indigenous women, in particular, have transferred skills and social capital gained through marketing agricultural and nonagricultural products in regional bulking centers and other markets to the commercialization of the new crops. Maintaining their visibility in marketing activities helped to protect women's control of household productive assets and incomes despite men's greater access to NTAX market structures.

Small-scale NTAX producers have been able to achieve, and continue to pursue, long-term socio-economic gains and significant social mobility (Fischer 2001). Most importantly, small-scale producers have been able to retain control of their land, absorb family labor, and exercise some measure of choice in controlling other means of production (such as credit and pest control), depending on the availability and quality of subcontracting and producer-organization options in their geographical areas and social networks. Given the diversity of crops and the variety of marketing and crop-management strategies employed, we believe that local producers retain effective, as well as nominal, control of their most important means of production. Given the importance of land and an agrarian lifestyle to the cultural meanings of livelihood, we believe that maintaining this control fundamentally underlies farmers' positive perceptions of NTAX production as a livelihood strategy.

While income distribution within indigenous populations may have become more uneven, the overall distribution of rural income has become less uneven in this context. It appears that, in all of our research sites, indigenous farmers who were able to expand their holdings through NTAX production were more likely to obtain additional land from the ladino rural elite than from less fortunate indigenous landholders. Given the social, political, and economic marginalization of indigenous peoples in highland Guatemala, we emphasize this aspect of our analysis of the distributional effects of NTAX production.

Social and cultural capital arising from deeply embedded social norms and cultural values has been noted among Maya communities in the Guatemalan highlands (Fischer 2001, Katz 2000) and elsewhere in Latin America as a potential basis for strengthening the economic and political positions of indigenous groups, particularly with reference to

agricultural and other export markets.[9] Our research points to the utility of social and cultural capital in exploiting new market opportunities—a melding of traditional and non-traditional economic and cultural relations. Producer organizations in Guatemala have been able to capitalize on many generations of normalized economic reciprocity and high levels of *confianza* (trust)—qualities that have been identified as essential for enabling credit unions and other associations to relieve production and marketing constraints (Pretty and Ward 2001; Uphoff and Wijayaratna 2000; Bebbington and Perreault 1999; Barham, Boucher and Carter 1996). One program located in Chimaltenango near our survey communities trains farmers to meet export quality standards, then buys their produce, packs it, and sells it directly to wholesalers in Miami. The profits are returned to farmers at the end of the year as dividends. This organization pushes non-traditional agriculture beyond purely economic calculations. The organization has based business relationships on *confianza* by providing credit, hiring farmers' family members to work in the packing plant, and offering maternal leave benefits and health care. In this way, whole families become involved in the export process. Despite dynamically changing agricultural processes, the Maya family and community are sustained in socially acceptable ways.

Even within less socially oriented collaborations such as the groups of farmers self-organized to work with exporters in our research communities, producers were able to establish mutual trust regarding the honoring of contracted prices, and this helped to form associations with more reliable exporters who also honored the contracts. Both these farmers and those who joined production cooperatives received much better prices for their crops than those who sold through intermediaries (Hamilton, Asturias de Barrios, and Sullivan 2001). These individuals are at once economic innovators and conservators of socio-cultural traditions that encompass principles of collective welfare and social organization. Women's traditional freedom to market independently and their relevant marketing skills proved important in securing voice in NTAX-related intrahousehold economic decision processes.

9. In highland Ecuador, the adoption of high-technology production and the successful manipulation of export market channels have increased socioeconomic stratification (Colloredo-Mansfeld 1999; Korovkin 1998) while also enabling more members of producer families to remain employed in their home communities—a "regionally specific alternative to full-fledged capitalism" (Korovkin 1998, 146). Further, non-traditional production and export marketing have served to reinforce traditional socio-economic reciprocity and variously-conceived forms of ethnic identification (Colloredo-Mansfeld 1999; Hamilton 1998), as well as to increase political solidarity, local control of development processes, and national political participation (Bebbington 1996; Cruz 1999; Meisch 1998).

In our sample, production and marketing constraints were alleviated somewhat by these socio-cultural assets. Positive results achieved by indigenous organizations in non-traditional markets elsewhere in Latin America suggest that these assets offer tremendous potential in terms of organizing to achieve better crop management, market opportunities, and environmental sustainability in the export sector (North and Cameron 2000; Bebbington 2000). However, sustained expansion in the small-scale sector that would reflect continued growth in household NTAX productivity, incomes, and capital accumulation cannot be expected without well-targeted national and international investment and some market restructuring in the small-scale sector. Creation and support of organizational structures that increase both ex-ante and ex-post access to capital have been fostered by external partners, and this effort should be expanded. Such external investment can help to support the incipient trend toward land de-concentration observed in our research area. However, direct attention to land distribution at the national level would have a more profound effect. In Guatemala, land redistribution has been the most politically charged and functionally difficult of all potential development agendas. Efforts by international donors and other actors to support market-based redistribution programs that take into account the realities of both macro- and micro- political economies have potential to achieve positive results under certain conditions, but have yet to reduce the primary constraint to small-scale production in Guatemala (de Janvry, Sadoulet, and Wolford 2001).

The potential of small-scale NTAX production to contribute to sustainable livelihoods and rural development in this region will ultimately rest on the playing out of the contradictions between local-level economic dynamism and related socio-cultural assets, on the one hand, and the underlying agrarian structures that continue to favor larger producers (Carter and Barham 1996), on the other. Both large- and small-scale producers will need to become better informed concerning processes of market saturation and more committed to reducing levels of pesticide use. Ultimately, neither the livings to be made in the small-scale sector nor the potential for restructuring can be understood as a matter of the purely rational calculation of economic risks, efficiencies, costs, and benefits. In exposing the paternalism of those who view Maya farmers merely as victims of the new global economy—dupes who unwittingly absorb most of its risks—a Kaqchikel social critic maintains:

> It is untrue that farmers don't understand the risks. They understand what the risks are. First, if they don't take care of the land, they won't have anything to pass to their children . . . If traditional products caused a lot of harm, there would come a time that we wouldn't be able to produce maize and beans. But if you analyze the costs of production of beans, of maize, of wheat, these really aren't profitable either. They never have been. But now these new crops have

come and they provide a little benefit to the families. Growing non-traditional crops involves the whole family. . . . And this is well adapted to Maya culture: doing things together. And this can provide unity. Let's take the case of snow peas. When it's harvest time, all the relatives all go out and harvest. This is the most important thing. They know the risks.

We contend that this analysis is not a form of false consciousness, but rather one component of an economic logic in which the productive uses of family land and labor carry values that cannot be measured merely in monetary opportunity costs.

The ability to control the land in which one's identity is vested and to use this land in ways that help to preserve culturally important webs of relationship and meaning may be viewed as an incalculable form of wealth and well-being. Given the success of local people in sustaining these bases for preserving families and communities, we have more confidence than many analysts in the ability of Maya farmers to also build increasingly well-informed and competitive production and marketing organizations and to chip away at the political-economic structural inequalities that also shape the market. From our perspective, such an incremental form of structural change would not be ideal,[10] but it would certainly be positive and sustainable. It is our hope that external partners will increasingly invest in the socially sustainable forms of market participation we have documented, thereby helping to protect and build on the hard-won gains of the past two decades in the central Guatemalan highlands.

10. In addition to external commitments to address land distribution, we also argue for greater state investment in rural education, nonagricultural industrial development, and related infrastructures so that rural people have a broader set of locally accessible socio-economic options.

Methodological Note: In the model we tested, the dependent variable is a measure of whether a woman has land-use decision input (measured by a value of 1 for households in which land-use decisions were reportedly taken by a woman independently or by a woman and man in partnership; households in which land-use decisions were reportedly taken primarily by a man were given a value of 0). Independent variables may include a mix of dichotomous, ranked, and interval measures. We tested a model that evaluated the independent effects of whether a woman owned land independently (1, 0); whether a woman owned land jointly with her husband (1,0); whether a woman was the single head of her household (1,0); whether a woman sold agricultural products (1, 0); the number of hectares planted by the household to NTAXs; and the degree of a woman's involvement in household commercial agricultural labor (measured on an 8-point scale that scored 1 point each for planting, cultivation, harvesting, and use of agrochemicals in NTAX production and in other commercial agriculture.

The parameters of the model are estimated using the maximum-likelihood method—i.e., the coefficients that make the observed results most likely are selected. The probability of the observed results given the parameter estimates is known as the model's likelihood. Since the likelihood is a small number (of less than 1), -2 times the log likelihood (-2LL) is used to evaluate how well the estimated model fits the data (Norusis 1990, 126). Under the null hypothesis that the model fits perfectly, –2LL has a chi-square distribution. If the model helps to explain the event, the –2LL will decrease. The model chi square measures the size of the overall –2LL decrease and whether the difference is statistically significant. The change in –2 LL disaggregates the model chi square by showing the proportion of the total decrease attributable to each independent variable and the significance level for the change.

Two of the potential determinants proved statistically significant in explaining the likelihood that a woman will have land-use decision input: her independent land ownership and agricultural marketing. The model chi square is 13.403 (–2LL decreased from 89.818 to 76.415).

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