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Gender, Time Use, and Change: The Impact of the Cut Flower Industry in Ecuador

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This article uses survey data from Ecuador to examine the effects of women's employment on the allocation of paid and unpaid labor within the household. I compare a region with high demand for female labor with a similar region in which demand for female labor is low. The comparison suggests that market labor opportunities for women have no effect on women's total time in labor but increase men's time in unpaid labor. The increase in men's time in unpaid work reflects women's increased bargaining power in the home.

Economic reforms in Latin America have led to a boom in the growth of nontraditional agriculture exports and along with it a large increase in the demand for rural labor, especially female labor (see Barham and others 1992, Quiroz and Chumacero 1996, Thrupp 1995). The expansion in off-farm employment has provided a needed income source for rural families, and it has had a profound impact on the economic and social fabric of rural communities. Agricultural industries and nontraditional products have grown in direct response to trade and macroeconomic reforms recommended by the World Bank and other institutions. Success stories in Latin America are frequently cited as examples for other countries to follow.[1] The Ecuadorian cut flower industry is a classic example of a growing agricultural export industry in Latin America and one that has a large demand for female labor.

This article investigates two questions about how household time allocation has changed as a result of the flower industry. The first is whether women who

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1. World Bank Country Assistance Strategies typically promote nontraditional agriculture for its high-growth potential. See, for example, the Uganda Country Assistance Strategies, *The Challenge of Growth and Poverty Reduction* (World Bank 1996).

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work in the flower industry are working harder as a result of combining market labor with unpaid labor at home. The second is whether there is some shifting of responsibility for unpaid labor traditionally performed by women to male household members. Such a change in participation in housework could imply a shift in gender roles or a tradeoff based on relative wages. Several recent studies have examined changes in time use in more industrial countries, and a growing body of literature is looking at similar questions about time use in developing countries.[2] In the United Kingdom, Jenkins and O'Leary (1997) found significant change in the composition of work for men and women, which they attributed to the increased participation of married women in the labor force. Manchester and Stapleton (1991) report similar findings for the United States.[3]

Most work on time use in developing countries has focused on the separate impacts for men and women, with little emphasis on the division of labor in the home and how it may change over time. An exception is a recent article by Fafchamps and Quisumbing (1998), which looks at the static determinants of the intrahousehold division of labor in Pakistan. They found that gender, family status, and human capital variables were all significant determinants, but they did not address the question of how or why the division of labor may change over time.

People often assume that gender roles are fixed in developing economies. Although it is true that roles in many developing societies are more narrowly defined for women, pressures from modernization are provoking swift changes. Married women's participation in paid labor has risen rapidly around the world, especially in export niches.

In Ecuador the flower industry is only 10 years old. Before it developed, women in these rural areas had little (if any) paid employment. Employment in flowers has been one of the first types of paid off-farm employment offered to women and the only employment offered to women in large numbers.[4] This kind of change in women's market participation is likely to induce some changes in household time allocation.

The challenge is to measure the dynamic effect of household labor supply decisions on the reallocation of responsibilities within the home when time-series data are not available and when, from a static modeling perspective, time allocation decisions must be assumed to be made simultaneously. One solution

2. For developing economies, see Alderman and Chishti (1990), Fafchamps and Quisumbing (1998), Ilahi (1999), Khandker (1988), and Skoufias (1993).

3. See also Bittman (1999) for a comparison of trends in Finland and Australia and van der Lippe and Siegers (1994) for the Netherlands. Bittman cautions that although gender differentials in housework in more developed economies are declining, men devote half the time that women do to unpaid work.

4. Firm managers and many others say that women are more efficient than men in the detail-oriented work required in the flower industry. Others assert that women are hired because they are willing to work for lower pay than men are. It is most likely some combination of factors: productivity, labor supply, and the historical association of women with postharvest agricultural work.

would be to model male and female decisions separately and treat women's income (or market participation) as exogenous to men's decisions to carry out housework. This is the working assumption in many noncooperative models, and it was a common assumption in early models of labor supply. For example, it was common to include husband's income as an exogenous determinant of female labor supply, because it was assumed—probably correctly for some time—that a husband's participation was independent of a wife's participation. For the purposes of this article, a separable model would negate the hypothesized relation between women's market work and male housework, an effect that is believed to take place over time.

The framework for this analysis is a model in which time use decisions in all activities are simultaneous and interlinked across household members. Directly estimating such a system of decisions is complicated by the large differences across households found in most developing societies, both in the number of people per household and in the types of relatives who live together. The effect of women's work on housework allocations is captured indirectly in two ways. First, time allocation outcomes are compared in two different "states of nature," one in a region in which flowers are produced and the other in a region where they are not. Second, reduced-form determinants of time use are estimated together with wages and a dummy variable for the flower-producing region.

I. The Conceptual Framework

Building on the framework proposed by Browning and Chiappori (1998), I characterize household welfare as a weighted sum of individual utilities. This approach follows in the tradition of modeling the household decision as a collective decision rather than assuming the household has one representative, or "unitary," utility function.

Let each member's unique utility contribute to household choices depending on their relative weight in the household, written as

$$U = \sum_{i=1}^{n} \mu^i U^i, \qquad \text{where} \quad \sum_{i=1}^{n} \mu^i = 1 \tag{1}$$

The choice functions that result from maximizing equation (1) subject to a budget constraint depend on the weights μ^i. However, as in the demand example described by Browning and Chiappori, we do not observe choice responses to changes in the μ's. We observe only choices made at one set of μ values for any given price-income bundle. Therefore, the weights can be written as functions of the parameters that determine the choices in question. Browning and Chiappori call these parameters "preference factors" and distinguish them from other factors that may also be included, such as changes in divorce laws or regional policy differences, which they call "distribution factors."

Expanding the basic model to show μ as a function of preference and distribution factors, we designate household welfare and the budget constraint by

$$U = \sum_{i=1}^{n} \mu^i \left(w^1, \ldots, w^n, W; H^1, \ldots, H^j\right) U^i \left(C^i, R^i\right) \tag{2}$$

$$\sum_{i=1}^{n} C^k - \sum_{i=1}^{n} w^i L^i = W \tag{3}$$

where U^i is the utility of individual i defined over the numeraire good (C^i) and leisure (R^i) consumed by individual i. Leisure comprises rest and recreation and is expressed by $R^i = T^i - L^i - D^i$, where T^i is the total time endowment, L^i represents paid labor, and D^i represents domestic labor.[5] The individual utility weights, $\mu^i(\cdot)$, sum to one over the n members of the household and differ across households by the household wealth, W, and the j household characteristics in the vector H. The utility weights differ across household members by the wage they earn in market labor, w^1. Domestic labor is a necessary service that has to be conducted by at least one member of the family and is defined by the constraint

$$\sum_{i} D^i = D_m \tag{4}$$

where D_m is the amount of time that needs to be allocated to domestic work in the mth household. Maximizing household welfare (equation [2]) subject to equations (3) and (4) and imposing nonnegativity constraints on individual labor supply and domestic work supply, $L^i \geq 0$, and $D^i \geq 0$, results in a series of labor and domestic work supply functions:

$$L_a{}^i = f(w^1, \ldots, w^n, W, \mu[w^1, \ldots, w^n, W; H^1, \ldots, H^j], \lambda^k) \tag{5}$$

for $i = 1, \ldots, n$ members of the M households, all j household characteristics; $k = 1, \ldots, 4$ Lagrange and Kuhn-Tucker multipliers, and where a is for paid labor and domestic work supply functions.

As equation (5) shows explicitly, wages affect the labor and domestic work supply functions directly as well as indirectly through the distribution function μ. The effect on μ can be thought of as a bargaining effect. As wage opportunities change among household members, the supply outcomes of each one can be affected beyond the traditional substitution and income effects of a wage change. Suppose one family member's wage increases relative to the others. The impact on the distribution function is unclear and would depend on the rules that determined the function. It is possible that the higher the wage earned by an individual, the higher his or her utility would be weighted, because the higher wage

5. For simplicity of presentation, home production is not included, because the focus is on the underlying structure of paid labor versus domestic labor supply decisions. Home production could be added, but it would lead to complications, as pointed out by Apps and Rees (1997) and discussed by Chiappori (1997). To avoid the pitfall associated with leaving it out that Chiappori notes—namely, that work in the home may accidentally be treated as leisure—all hours of work, whether in the home or elsewhere, are counted as either paid or domestic (unpaid) labor. This is possible because detailed information on time use by activity is available.

increases the person's ability to survive independently away from the household. However, a higher wage would have an ambiguous bargaining effect on labor supply, depending on the relative value that the individual places on consumption versus leisure.

The bargaining effect of a higher relative wage would have a clear impact on domestic work supply ("housework"). Because housework is not paid, the person would choose more market work or more leisure but never more housework. An exception would be the case in which the work itself produces positive utility for the individual. That may be true for housework that involves taking care of other family members, but then most forms of work have some aspects that provide positive utility. Overall, a higher wage would translate into less housework for most individuals through a bargaining effect.

II. The Data

The survey was conducted in two regions of northern Ecuador, both around the small towns of Cotocachi and Cayambe. The two regions were chosen for their cultural and ecological similarities. Each region contains a relatively concentrated regional center in the lowlands and rural hamlets in the neighboring hillsides. The regions are about 200 km apart; Cotocachi is two hours and Cayambe is three hours by car from the capital city, Quito.

The data were collected in May and June 1999 as part of a larger study of the effects of flower development on household resource allocation decisions. The survey was designed specifically to answer the questions raised in this article on time use as well as to answer questions about intrahousehold consumption and production decisions. In total 558 households were surveyed, resulting in 2,541 individual observations from all members of each family (1,861 individuals were 10 years or older). The survey is modeled after the World Bank's Living Standards Measurement Survey and uses many of the same modules used in living standards measurement surveys conducted by the Ecuadorian government. The same team of Ecuadorian consultants that carried out the national surveys conducted the survey for this project. Two Ecuadorian anthropologists conducted a complementary series of participatory workshops, focus groups, and individual interviews in the same two regions using the same sample design.

The survey data include detailed modules on expenditures, economic activity (including agriculture and small businesses), health, education, fertility, credit and savings, and time use. Two types of time use data were collected because of their different strengths.[6] The 24-hour data are considered by many to be more accurate because they are more detailed and it is easier for a respondent to remember what was done the day before. But 24-hour data are more likely to miss

6. See Juster and Stafford (1991) and Robinson and Gershuny (1994) for a full discussion of time use measurement issues.

unusual or irregular activities. Because men's contribution to housework may be an example of an irregular activity or one that is not done daily, we also asked for time dedicated to housework, rest, recreation, and work each day the previous week. Weekly data of this nature have the disadvantage of being less precise and more subject to recall error, but they have the advantage of being less burdensome to the interviewee. The 24-hour recall data were collected only for the male and female heads of household. The weekly data were collected for all household members interviewed. In the flower industry region the sample was also stratified by whether or not the wife or female household head works in the flower industry.

A classic problem arises when comparing two sites, or two experimental groups, when the effect being measured is more (or less) likely to occur in the treated group for reasons unrelated to the treatment. This problem would arise here if the location choice of the flower industry entrepreneurs were correlated with qualities of the workforce that also influence workers' time allocation decisions. According to flower producers, the characteristics of the workforce are irrelevant to their location choice, which was guided by the unique combination of microclimatic characteristics in Cayambe. They claim that anyone can be trained in a short period to do the work required. One may argue that in reality the flower producers choose a more productive workforce—younger and more educated—and that more productive and less productive workers allocate their time between market and domestic work differently. But most of these kinds of worker characteristics can be controlled for in the analysis.

The main impact of the flower industry in the Cayambe region has been to offer much more and better paid employment for women. Median wages paid to women in the industry are twice those paid in other industries, even in other industries in the Cayambe region.

Before the flower industry moved into the area in the late 1980s, Cayambe had been a center of dairy production and milk-related products. The "control" area, Cotocachi, resembles Cayambe as it was about 15 years ago. It has a stable economy with a small artisan industry in leather products. As a result of the stability of the local economy in Cotocachi, few people migrate to the flower-producing region, and women are much less likely than men to migrate at all from Cotocachi.

Why have the two labor markets not equilibrated? Why would the residents of Cotocachi not move or even commute to work in the flower industry given the higher wages offered there? For men the jobs in the flower industry are not clearly better paying than the jobs in Cotocachi. For women the main reason they do not migrate is the cultural importance of staying close to home, coupled with the fact that their families are not excessively poor. In the qualitative work that accompanied the survey, we found that Cotocachi women did not view flower employment as an option. They said either that their husbands would not allow them to work or that the work would be detrimental to family relations. Here is a typical explanation from a Cotocachi woman:

> He didn't want me to go out [to work]. . . . He refused to let me. . . . It was a problem when I worked [before]. . . . His family wouldn't talk to me, [they would say] "Why go outside to work when you can work in the house itself?" They talked about it so much even my own brothers and sisters were asking, "Why are you working?"

Women from Cayambe faced similar pressures when they first wanted to work in the flower industry. Almost all of the married women interviewed said their husbands were initially opposed to them working. But once they started earning money, opposition decreased and their economic contributions were appreciated. Many of the younger women said their parents had been opposed to the idea. Many parents wanted their daughters to stay in school. Here are quotations from Cayambe women about their decisions.

> He told me "no." . . . but the decision was mine.

> In my case, my parents did not want me to work, but [because of] the economy, you had to because there wasn't enough money to pay for school.

For women in Cayambe who did not work and who participated in the quantitative survey, more than half said they were not working because of family opposition.[7]

The main difference between the inhabitants of Cotocachi and the migrants to Cayambe is in the wage opportunities for men. The migrants went in search of employment for both the men and the women of the family. Cotocachi men earned wages similar to those offered by the flower industry (more on wages later), and it was not socially acceptable for the women to travel alone. For these reasons the two markets for women's labor did not equilibrate.

Cayambe and Cotocachi have different microclimatic characteristics but similar ecological features, cultures, and histories of land tenure (table 1). Descriptive statistics give only a limited comparison of the two areas, because we would expect to see differences in Cayambe as a result of the flower industry. The main differences are the age profiles and the proportion of migrants to the area. The population of Cayambe is generally younger and has a higher proportion of migrants. Most of the other basic characteristics, including education levels, marriage patterns, household composition, religious affiliations, and other organizational affiliations, are similar.

The large proportion of migrants in Cayambe raises the question of how the migrants affect the comparability of the groups. Migrants to Cayambe made up 26 percent of the sample population in Cayambe and only 6 percent of the sample in Cotocachi. The migrants in Cayambe were from all over the country, but a large number were from the poorer areas along the coast. Migrants were more likely to be young adults. With fewer elderly in the migrant sample, a higher

7. See Newman and others (forthcoming) for general findings from the quantitative and qualitative studies.

TABLE 1. Demographics of Cayambe and Cotocachi Areas

Item	Cayambe all		Cayambe migrants		Cotocachi	
	Number	Percentage	Number	Percentage	Number	Percentage
Sample size	1,916	75	497	26	625	25
Age group						
13 and younger	684	35.7	66	13.3	209	33.4
14–19	260	13.6	88	17.7	74	11.8
20–25	298	15.6	139	28.0	55	8.8
26–35	309	16.1	129	26.0	73	11.7
36–45	147	7.7	49	9.9	60	9.6
45–55	97	5.1	14	2.8	51	8.2
56–65	67	3.5	8	1.6	43	6.9
66 and older	54	2.8	4	0.8	60	9.6
Education						
None	137	8.7	10	2.0	59	10.6
Nursery	10	0.6	2	0.4	0	0
Preprimary	52	3.3	1	0.0	14	2.6
Basic education	5	0.3	0	0.2	0	0
Primary	834	52.9	256	51.5	300	54.8
Secondary	460	29.2	204	41.1	138	25.2
Superior university	72	4.6	21	4.2	33	6.0
Superior not university	6	0.4	3	0.6	2	0.4
Graduate	0	0.0	0	0.0	1	0.2
Marital status						
Free union	163	13.7	109	26.1	27	6.7
Married	501	42.0	147	35.3	198	49.0
Single	435	36.5	138	33.1	132	32.7
Separated	41	3.4	15	3.6	10	2.5
Divorced	13	1.1	4	1.0	7	1.7
Widowed	40	3.4	4	1.0	30	7.4
Female head of household	95	23.1	33	19.5	37	25.3
Household with children younger than 15 years old	684	35.7	66	13.3	209	33.4
Households with children younger than 6 years old	340	17.7	0	0.0	78	12.5
Relation to head of household						
Household head	412	21.5	169	34.0	146	23.4
Spouse	284	14.8	108	21.7	99	15.8
Son or daughter	892	46.6	121	24.4	297	47.5
Son- or daughter-in-law	33	1.7	10	2.0	11	1.8
Niece or nephew	157	8.2	6	1.2	44	7.0
Mother or father	13	0.7	4	0.8	5	0.8
Mother- or father-in-law	6	0.3	2	0.4	6	1.0
Brother or sister	51	2.7	38	7.7	7	1.1
Brother- or sister-in-law	15	0.8	11	2.2	2	0.3
Other relatives	36	1.9	18	3.6	5	0.8
Other	17	0.9	10	2.0	3	0.5

Note: A large-sample rank sum test was performed on the Cayambe and Cotocachi samples, and the only variable distributions in the table for which the hypothesis that they are the same was rejected were "age group" and "relation to head of household." The differences in "relation to head of household" across Cayambe and Cotocachi, however, are quite small, reflecting the strength of the test because of its large sample properties.

Source: Surveys conducted in May and June 1999; see text.

percentage of the sample had secondary education. Migrants had smaller families, fewer children, and fewer female-headed households. Perhaps the migrants had cultural norms that made them more open to gender role changes. Because of these differences, migrant status is separately included in the econometric estimations.

III. Time Use Outcomes: How Do Allocations Differ in Cayambe and Cotocachi?

Time use in the major daily activities for the past 24 hours is shown in table 2. The total time worked by women in Cayambe was slightly less than that worked by women in Cotocachi, although the differences are not significant. Compared with men, women in both areas spent significantly more time working, including both paid work and housework.[8] The ratio of men's time in total work to women's was only slightly higher in Cayambe (82 percent) than in Cotocachi (80 percent). Men worked about 8.5 hours a day, and women worked about 10.5 hours a day—a difference that is common in developing economies (Ilahi 1999, World Bank 2001). Men's and women's total working hours are much more similar in industrial countries.

Not surprisingly, women in Cayambe spent more time performing paid work (229 minutes, or 3.8 hours, a day) than women in Cotocachi (171 minutes, or 2.9 hours, a day), but women in both regions spent less time performing paid work than men. Given the relatively short history of women's participation in paid work, it is not surprising that women worked less than men, but this is not representative of the population, because the survey deliberately included women who did not work in the sample design. Men in Cayambe spent significantly more time performing paid work (361 minutes, or 6 hours, a day) than men in Cotocachi (302 minutes, or 5 hours, a day).

Women did most of the housework in both Cayambe and Cotocachi (table 2). Cayambe women spent an average 327 minutes (5.5 hours) a day on housework, whereas men averaged 62 minutes a day of housework. In Cotocachi women spent 353 minutes (5.9 hours) on housework, and men spent 57 minutes. Men did slightly more housework in Cayambe than in Cotocachi, and women did slightly less.

Much larger differences emerge when looking at marital status and labor market participation (table 3). Married male household heads who worked in Cotocachi performed an average of 31 minutes a day of housework, whereas married male household heads who worked (in any job) in Cayambe performed an average of 57 minutes of housework a day. Both sets of married men did more

8. All reported differences are statistically significant unless reported otherwise. However, in subgroups such as married people, strictly speaking the sample was not designed to make these statistical comparisons. There are too few observations to correct the standard errors in several cases of the more detailed subgroup comparisons.

TABLE 2. Use of Time, by Gender and Marital Status
(minutes per day)

Activity	Men	Women	Married men	Single men	Married women	Single women
Cayambe						
Farm work	60.26[a]	51.42[a]	62.95[a]	31.04	52.51[a]	48.91
Paid work	360.69[a,b]	228.67[a,b]	364.64[a]	317.71	226.94[a,b]	232.62
Community work	13.09	4.42	13.26	11.25	5.30	2.42
Housework	61.79[b]	327.11[b]	62.90[a,b]	49.67[a,b]	331.14[b]	317.90[b]
Total work	516.48[b]	626.90[b]	524.40[b]	430.20[b]	631.33[b]	616.81[b]
Recreation	100.41[b]	66.44[b]	96.13[b]	146.88[b]	70.36[b]	57.50[b]
Personal care	328.06[a,b]	249.41[a,b]	325.10[b]	360.21[a,b]	243.90[a,b]	261.98[b]
Total time	944.94[a]	942.76[a]	945.64[a]	937.38	945.59[a]	936.30
Number of observations	298	411	270	28	286	125
Cotocachi						
Farm work	116.01[a]	79.31[a]	118.14[a]	96.00	81.47[a]	74.05
Paid work	302.45[a,b]	171.02[a,b]	311.65[a,b]	216.00	166.88[a,b]	181.07
Community work	13.85	11.46	15.32	0.00	14.71	3.57
Housework	57.36[b]	353.45[b]	38.94[a,b]	230.50[a]	369.87[b]	313.57
Total work	507.26[b]	630.38[b]	499.84[b]	577.00	648.87[b]	585.47
Recreation	108.17	74.10	103.72	150.00	68.68	87.26
Personal care	289.52[a,b]	204.56[a]	299.95[b]	191.50[a]	191.82[a,b]	235.48
Total time	904.95[a]	909.03[a]	903.51[a]	918.50	909.36[a]	908.21
Number of observations	110	144	99	11	102	42

	Cayambe			Cotocachi		
Men/women ratio	All	Married	Single	All	Married	Single
Farm work	1.17	1.20	0.63	1.46	1.45	1.30
Paid work	1.58	1.61	1.37	1.77	1.87	1.19
Community work	2.96	2.50	4.65	1.21	1.04	0.00
Housework	0.19	0.19	0.16	0.16	0.11	0.74
Total work	0.82	0.83	0.70	0.80	0.77	0.99
Recreation	1.51	1.37	2.55	1.46	1.51	1.72
Personal care	1.32	1.33	1.37	1.42	1.56	0.81

Note: Figures are based on 24-hour data. Total work includes time spent performing other activities (fetching water, selling and repairing homes).

[a]Significantly different from that of the opposite area at 95 percent confidence.

[b]Significantly different from that of the opposite gender at 95 percent confidence.

Source: Surveys conducted in May and June 1999; see text.

housework when their wives worked, but men in Cayambe in both categories spent significantly more time doing housework than men in Cotocachi.

Table 3 also shows a large flower sector impact. Married male household heads who worked in flowers did more housework than those who worked in other sectors (69 minutes versus 47 minutes), and this difference grew when their wives also worked in the sector. Married and working male household heads did the most housework of any group of men (71 minutes) when they worked in flowers and their wives worked (mostly in flowers). Married male household heads

TABLE 3. Time Spent Performing Household Tasks, by Gender, Marital Status, and Labor Market Participation

Item	Cayambe			Cotocachi			Difference in means *t*-test[a]
	Number	Mean	SE	Number	Mean	SE	
Male household head, married[b,c]							
Works	256	57.41	5.36	93	31.18	8.07	0.0050
And wife works	168	62.49	6.56	44	31.93	11.75	0.0160
And wife doesn't work	88	47.73	9.24	49	30.51	11.22	0.1258
Works in flowers	120	68.79	8.02*[c]	93	31.18	8.07	0.0007
And wife works	99	70.76	8.66	44	31.93	11.75	0.0058
And wife doesn't work	21	59.52	21.18	49	30.51	11.22	0.0960
Doesn't work in flowers but works	136	47.38	7.10*	93	31.18	8.07	0.0690
And wife works	69	50.62	9.93	44	31.93	11.75	0.1164
And wife doesn't work	67	44.03	10.21	49	30.51	11.22	0.1897
Female household head, single[c]							
Works	86	276.48	22.59	33	274.70	27.11	0.5176
Works in flowers	51	199.84	23.10*	33	274.70	27.11	0.0205
Doesn't work in flowers	35	388.14	37.05	33	274.70	27.11	0.9914
Wife of household head[b,c]							
Works	242	291.09	12.69	86	354.91	19.58	0.0045
And husband works	232	287.88	12.99	83	359.36	19.88	0.0021
Doesn't work	44	528.86	33.47	16	450.31	42.12	0.8980
Works in flowers	145	232.49	12.45*	86	354.97	19.58	0.0000
Works in flowers and husband works	143	230.92	12.53*	83	359.36	19.88	0.0000
Doesn't work in flowers, but works	97	378.69	22.96*	86	354.91	19.58	0.7812
And husband works	89	379.42	24.37*	83	359.36	19.88	0.7360

*Significant difference at 95 percent or more between those in the treatment group working in flowers and those working in other sectors.

[a]The tests for different means are $\mu^a > \mu^b$ for men and $\mu^a < \mu^b$ for women.

[b]The total number of married male household heads does not exactly match the number of wives of male household heads due to missing responses (there are 271 wives and 267 husbands).

[c]Not all subcategories are shown. The subcategories that are missing have too few observations to perform tests on their means.

Source: Author's calculations based on surveys conducted in May and June 1999; see text.

who worked in another sector and whose wives worked spent 51 minutes a day on housework. Although not significant, men who worked but whose wives did not spent more time on housework in Cayambe than in Cotocachi. This is especially interesting because the higher values for Cayambe men when women do not work is clearly not a substitution or income effect. Overall, these data suggest that men in Cayambe do more housework whether their wives work or not, but especially so if their wives work and if the men themselves work in the flower industry.

What is it about the flower sector that would induce higher levels of unpaid work by men? One possible explanation is wage differences. Men were paid more

than women on average (and at the median) in both Cayambe and Cotocachi, and this was also true of the subgroup of flower industry workers in Cayambe (table 4). However, the differences between men and women were much smaller among workers in the flower industry, with men earning 5,626 sucres and women averaging 5,552 sucres. These figures were much closer than the average figures in other sectors in Cayambe, where men average 5,817 and women average 3,704 sucres. Among married couples who worked in the flower industry, women actually earned more than men did.

Among working women, married women in Cotocachi did much more housework (355 minutes, or 5.9 hours, a day) than married women in Cayambe (291 minutes, or 4.9 hours, a day) (see table 3). The impact of the flower sector was quite strong. Among married Cayambe women who worked, those who worked in flowers spent much less time doing housework (232 minutes, or 3.9 hours a day) than women in other sectors (379 minutes, or 6.3 hours). In fact, the average time spent on housework by Cayambe women working in other sectors was more than that of women in Cotocachi. The flower impact is also seen in the amount of housework done by wives employed in the flower sector whose husbands also worked in the sector (222 minutes, or 3.7 hours, a day) compared with women whose husbands worked in other sectors (253 minutes, or 4.2 hours, a day). These statistics are symmetrical to the findings for men and can also be explained by the relatively higher wages for women in the flower industry.

The weekly data (see table 5) reveal the same patterns as the 24-hour data. What is evident in the weekly data, which are more representative for single people be-

TABLE 4. Wages by Gender, Marital Status, and Work Type

	Men				Women			
	N	Mean	Median	SD	N	Mean	Median	SD
Cotocachi								
All	141	5,668	3,000	8898	118	3,451	2,112	4,585
Married	101	6,454	3,000	10175	53	3,340	2,308	2,697
Cayambe								
All	444	5,715	4,568	5912	479	4,977	4385	5,719
Married	297	5,966	4,686	6263	225	5,687	4,761	6,656
All who work in flowers	236	5,626	4,823	3880	330	5,552	4,630	5,833
Married who work in flowers	157	5,913	4,938	4290	163	6,263	4,941	6,756
All who work in other sectors	208	5,817	3,846	7595	149	3,704	1,978	5,257
Married who work in other sectors	140	6,025	4,075	7929	62	4,173	2,464	6,182

Source: Author's calculations based on surveys conducted in May and June 1999; see text.

TABLE 5. Average Hours per Week Spent Performing Main Activities by Gender and Marital Status

Activity	Men	Women	Married men	Single men	Married women	Single women
Cayambe						
Paid work	39.1[a]	33.5[a,b]	50.6[a]	36.3[a]	25.9[a,b]	31.3[a,c]
Housework	7.0[a]	24.0[a]	7.8[a,c]	30.8[a,c]	6.1[a]	18.7[a]
Recreation	15.3[a,b]	12.8[a]	12.8[c]	11.5	18.2[a]	13.9[a]
Sleep	56.3[b]	56.6[b]	55.1[b]	55.9[b,c]	57.7	57.1[b]
Cotocachi						
Paid work	36.9[a]	28.5[a,b]	53.5[a]	31.7[a]	18.5[a,b]	26.1[a,c]
Housework	6.5[a]	24.4[a]	5.9[a,c]	34.2[a,c]	7.0[a]	17.2[a]
Recreation	13.6[b]	12.7	11.2[c]	11.6	16.3[a]	13.5[a]
Sleep	58.3[b]	58.5[b]	57.3[b]	57.8[b,c]	59.5	59.0[b]

	Cayambe			Cotocachi		
Men/women ratio	All	Married	Single	All	Married	Single
Paid work	1.17	1.39	0.83	1.29	1.69	0.71
Housework	0.29	0.25	0.33	0.27	0.17	0.41
Recreation	1.20	1.11	1.31	1.07	0.97	1.21
Sleep	0.99	0.99	1.01	1.00	0.99	1.01

Note: Figures are based on weekly data. Sum includes time in other activities (fetching water, selling and repairing homes).

[a]Significantly different from that of the opposite gender at 95 percent confidence.

[b]Significantly different from that of the opposite area (Cayambe or Cotocachi) at 95 percent confidence.

[c]Significantly different from that of the opposite area (Cayambe or Cotocachi) at 90 percent confidence.

Source: Author's calculations based on surveys conducted in May and June 1999; see text.

cause of the way they were collected, is that single men in Cayambe and Cotocachi spend almost the same time performing housework. This makes the difference among married men even more remarkable.

IV. Determinants of Time Use by Gender

This section presents an econometric analysis of all the factors that may determine time use. Potential determinants include individual characteristics, such as age, education, and marital status, as well as household and regional characteristics. One goal of the analysis is to differentiate the wage-related substitution effects from the bargaining effects specified in the distribution function $\mu(\cdot)$. Men in Cayambe spent more time performing housework. Was this merely because of wage differences, or was it also because women gained bargaining power over time as a result of their access to regular wage employment? Intuitively, it is clear that there was more than just a pure wage–leisure tradeoff involved, given that women's total time in both domestic and paid work far exceeded that of men. If

economic forces were the only forces at work, we would have to conclude that women preferred much less leisure than men preferred, even in Cayambe, where their market wages were similar. As with the imbalance in leisure, the imbalance in housework responsibilities by gender is a social norm. The most likely way for that norm to change is through women's increased bargaining power gained from market wages.

It is striking to hear how some women in Cayambe described the changes they have experienced:

> When my husband says to me, "Why don't you iron the clothes?" I say, "You too grab the iron and iron." I say, "I don't have time." He keeps quiet, he doesn't say anything to me, he knows he can't change anything.

The bargaining effects of wages on time use are difficult to separate from the substitution effect of wages. To the extent that wages are influencing behavior through a bargaining effect in this analysis, the Cayambe dummy could capture the effect, because the two sample sites are very comparable except for the presence of the flower industry. Own wages and spouses' wages are used together with the Cayambe dummy to help separate the two effects. The wages would be more likely to capture the substitution effects because theoretically they have the most direct impact on utility. The Cayambe dummy is more likely to capture the bargaining effect, because the whole region would be subject to the changing social norms.

Three models were used to test the hypotheses, the most appropriate of which was the censored least absolute deviation (CLAD) model. A Heckman model was originally chosen to correct for self-selection bias. With the Heckman model, one must specify at least one or two variables as determinants of either a person's participation in an activity or the amount of time he or she spent in the activity. There are no theoretical guidelines for making this choice, however, and the results can differ significantly depending on the choice made. The Tobit model, a single-equation model in which the censoring of values at zero is accounted for in the estimated function, also requires the errors to be normally distributed. Tests for normality, looking at skewness and kurtosis, failed.[9]

The CLAD model has the advantage of not requiring any assumptions about the distribution of the errors.[10] Consistent estimates for the β vector are obtained by minimizing

$$\sum_{i=1}^{n} \left| y_i - \max(0, x_i\beta) \right| \tag{6}$$

9. Several models were presented in earlier versions of this article, and the results were all qualitatively similar. An earlier article and other estimates are available on request.

10. See Deaton (1997) for a detailed explanation of this model, proposed by Powell (1984), and for the estimation method proposed by Buchinsky (1994). The method consists of iterative median regressions (in which the observations for which the predicted values are less than zero are discarded until all predicted values are positive) and standard errors are based on bootstrap estimates.

where y_i is measured as the share of paid or unpaid labor and x_i represents a vector of all determinants including the wages and the Cayambe location dummy.

The disadvantage of using this estimator compared with the Tobit is the reduced precision: The estimation method uses a smaller sample, and in a test by Deaton (1997) the standard errors were found to be one and a half times larger than those from Tobit. In larger samples, such as 1,000, according to Deaton, the bias-variance tradeoff becomes more favorable. Since this sample is relatively small, the Tobit results are also presented from one of the main housework models (tables 6 and 7).

The econometric model estimated for the Tobit is written as

$$
\begin{aligned}
& y_i^* = \beta_0 + \beta_x' x_i + \beta_w w_i + \beta_h' h_i + \varepsilon_i, \\
& y_i = 0 \quad \text{if } y_i^* \le 0, \\
& y_i = y_i^* \quad \text{if } y_i^* > 0.
\end{aligned} \tag{7}
$$

In this equation y is measured as the share of unpaid labor, x_i represents a vector of individual characteristics, w_i represents the individual's own hourly wage, and h_i represents a vector of household characteristics for individual i, including the Cayambe location dummy.

The determinants of time use were estimated separately by gender, because the main goal is to understand how male and female behaviors differ not from each other but from members of the same gender. The parameters affecting time allocation for men and women are assumed to differ, particularly for time allocation in housework. Because the households are not homogeneously structured, the share of each individual's contribution to total household labor or domestic work is estimated.

Hourly wages were included in the models because of the importance of testing for a bargaining effect. Predicted wages were used to include nonworking household members. The predicted wage was estimated as a function of age, education, urban location, and variables thought to affect the wage but not labor allocation. These variables included mother's education, tenure on the job, and the ethnic background of the household (assuming there is some level of discrimination against indigenous household members).

Another complication is that the model should include the wages of other relatives in the household or some measure of relative wages. This was found to have serious limitations because of the heterogeneity across households. Different sizes, compositions, and numbers of adults who work make it impossible to have representative wages for each type of family relation. To reduce this problem and others related to heterogeneous households, we estimated wages separately for wives and husbands. The wife's or husband's wages were included in those estimates along with the individual's own wage. Only one household member is included in these models to reduce errors associated with possible correlation across family members. The weekly time use data were used because of the larger sample size.

TABLE 6. CLAD and Tobit Estimates of Men's Share of Time Performing Housework and Paid Work
(dependent variable = individual's share of housework)

Item	Housework			Paid work	
	Tobit All men	CLAD All men	CLAD Married household heads[a]	CLAD All men	CLAD Married household heads[a]
Age/10	–0.0 (–0.09)	–0.03 (–0.94)	–0.07* (–1.82)	0.25* (7.11)	0.20* (3.55)
Age squared/100	0.0 (0.09)	0.0 (0.78)	0.0 (1.52)	–0.0* (–7.14)	–0.0* (–3.88)
Education	–0.002 (–0.59)	0.007* (2.00)	0.004 (0.85)	–0.006 (–1.12)	0.006 (0.92)
Age difference between wife and husband	n.a.	n.a.	0.002 (1.09)	n.a.	0.002 (0.75)
Education difference between wife and husband	n.a.	n.a.	0.000 (0.03)	n.a.	0.014 (1.57)
Married	0.061* (2.10)	0.052* (1.89)	n.a.	0.076* (2.90)	n.a.
Widowed, divorced, or separated	0.216* (3.78)	0.161 (1.14)	n.a.	0.112 (1.01)	n.a.
Own wage (thousands of sucres)	–0.006 (–0.92)	–0.007 (–1.31)	–0.003 (–0.46)	0.032* (4.05)	–0.004 (–0.34)
Wife's wage (thousands of sucres)	n.a.	n.a.	–0.001 (–0.81)	n.a.	–0.000 (–0.00)
Household size	–0.050* (–7.57)	–0.038* (–6.00)	–0.022* (–2.35)	–0.056* (–9.43)	–0.086* (–10.34)
Number of children	0.045* (4.65)	0.029* (3.77)	0.015 (1.31)	0.049* (6.11)	0.091* (6.85)
Ratio of females to males in household	–0.038* (–3.01)	–0.037* (–3.50)	–0.029 (–1.63)	0.005 (0.39)	0.019 (1.04)
Household assets(thousands of sucres)	–0.0002* (–2.19)	–0.0002* (–2.20)	–0.0001 (–1.40)	–0.0002 (–0.79)	0.000 (0.67)
Urban location	0.080* (3.68)	0.060* (2.85)	0.077* (3.32)	–0.066* (–2.47)	–0.022 (–0.78)
Cayambe region	0.120* (5.34)	0.128* (5.28)	0.056* (2.33)	–0.029 (–1.47)	–0.064* (–1.82)
Migrant in Cayambe region	0.015 (0.73)	0.022 (1.43)	0.048* (2.32)	0.022 (1.05)	–0.015 (–0.71)
Number of observations	789	539	305	701	360
Pseudo R^2	0.3344	0.1169	0.1248	0.2895	0.1971

n.a. Not applicable.
*Significant at the 95 percent level.
[a]Only one person per household is selected for this model to control for correlation within the household.
Note: t-statistics are shown in parentheses.
Source: Author's calculations based on surveys conducted in May and June 1999; see text.

TABLE 7. CLAD and Tobit Estimates of Women's Share of Time Spent Performing Housework and Paid Work
(dependent variable = individual's share of housework)

	Housework			Paid work	
Tobit Item	CLAD All women	CLAD All women	CLAD Married women[a]	CLAD All women	Married women[a]
Age/10	0.22* (8.59)	0.25* (6.91)	0.10 (0.98)	0.71* (8.49)	–0.03 (–0.42)
Age squared/100	–0.0* (–7.72)	–0.0* (–6.13)	–0.0 (–1.09)	–0.0* (–8.99)	–0.0 (–0.39)
Education	0.005 (1.46)	0.007 (1.27)	0.001 (0.11)	0.009 (1.56)	–0.011* (–2.25)
Age difference between wife and husband	n.a.	n.a.	0.004 (1.56)	n.a.	–0.005* (–2.48)
Education difference between wife and husband	n.a.	n.a.	–0.004 (–0.30)	n.a.	–0.026* (–3.08)
Married	0.126* (6.20)	0.153* (7.30)	n.a.	–0.079* (–2.05)	n.a.
Widowed, divorced, or separated	0.097* (3.18)	0.114* (2.38)	n.a.	0.240* (3.20)	n.a.
Own wage (thousands of sucres)	–0.020* (–2.62)	–0.024* (–2.03)	–0.015 (–0.76)	–0.023* (–1.70)	0.011 (1.05)
Husband's wage (thousands of sucres)	n.a	n.a.	0.001 (0.62)	n.a.	–0.001 (–0.32)
Household size	–0.083* (–16.26)	–0.091* (–14.06)	–0.082* (–5.26)	–0.098* (–9.22)	–0.099* (–8.21)
Number of children	0.072* (9.48)	0.070* (9.14)	0.061* (3.06)	0.077* (5.33)	0.082* (4.98)
Ratio of females to males in household	–0.051* (–6.09)	–0.056* (–5.20)	–0.050* (–2.07)	0.034* (2.51)	0.022 (1.51)
Household assets (thousands of sucres)	–0.000 (–0.60)	–0.000 (–1.16)	0.000 (0.19)	–0.000 (–0.58)	0.000 (0.46)
Urban location	–0.046* (–2.43)	–0.050* (–2.41)	–0.081* (–1.88)	–0.069* (–2.18)	0.030 (1.15)
Cayambe region	0.003 (0.14)	–0.023 (–1.33)	–0.116* (–2.29)	–0.026 (–1.03)	0.000 (0.01)
Migrant in Cayambe region	0.022 (1.21)	0.035 (1.62)	–0.001 (–0.02)	0.049* (1.78)	–0.021 (–0.90)
Number of observations	992	934	364	724	335
Pseudo R^2	0.9525	0.3322	0.2083	0.2340	0.2520

n.a. Not applicable.
*Significant at the 95 percent level.
[a]Only one person per household is selected for this model to control for correlation within the household.
Note: t-statistics are shown in parentheses.
Source: Author's calculations based on surveys conducted in May and June 1999; see text.

Men's Labor Allocation

The most important result from the housework models is that Cayambe men spent more time in housework even when measured against the impacts of other variables. The wage variables that could measure a direct substitution effect had no impact on men's time in housework. On the contrary, the Cayambe location dummy, which represents an indirect wage bargaining effect, always had a positive and significant effect on men's housework (recall from equation [5] that μ, the distribution factor, affects time allocation indirectly by being a function of the wage). Wages were significant in the other models of labor allocation, such as the models for men's and women's paid labor supply and for women's unpaid labor supply, which shows that the wage variables generally had the expected effects.

For married male heads of households, the only effects that were significant were migrant status, the Cayambe dummy, and the urban dummy. The lack of significance of the other variables is assumed to stem from the loss of precision from using CLAD and the one-person-per-household sample. Despite these limitations, the results point to a strong bargaining effect on men's housework. In the CLAD model for all men, the magnitude of the impacts also shows the importance of the Cayambe region in determining men's housework. The estimated coefficient for Cayambe is about twice as large as the other significant dummy variables (married and living in an urban location).

Household-level effects were also important, showing that men's contribution to housework grew with the number of children and shrank with the total number of household members (because more members can share the work). The importance of the gender composition of the household was clearly evident: Men's housework shares declined as the ratio of women to men in the household increased. Assets were also included to test whether men in wealthier families would feel less pressure to take on housework, and this was shown to be the case.[11]

The determinants of men's paid labor supply are characteristic of classic labor supply. There is no evidence of men's paid labor being influenced by the flower sector or the gender composition of the household. Age had a positive and diminishing effect on the share of hours worked, but education had an unexpected negative effect. Own wages had a positive effect in the larger model, but wives' wages did not in the smaller one. Men who were married or had been married worked more than single men did, and men worked more if there were more children in the home. Interestingly, the Cayambe location did not have an impact on men's share of hours worked, suggesting that men had similar opportunities to work in both regions.

11. Individual assets would have been preferable, but the data proved to be too poor to be useful at the individual level. Most assets were reported at the household level.

Women's Labor Allocation

The results from the estimation of the housework model for women reveal the gender-specific nature of this work as well as the growing influence of the labor market. In the models for all women, age had a positive and diminishing effect on housework. Having higher education had no impact, but being married or previously married had a positive impact on women's housework, all as expected. The effect of wages was significant and negative, indicating that price substitution was relevant to women's unpaid labor allocation. The Cayambe dummy was significant only in the married women's housework model, but it was negative, indicating the other side of the bargaining effect: Women bargained in Cayambe to do less housework. As it did for married men, the CLAD model for women had fewer significant impacts than the other models, but household characteristics and Cayambe were the main determinants.

Household characteristics were important determinants of women's time in housework, and their effects were similar to those for men. A higher ratio of women to men in the home reduced the woman's share of household work.

The estimates of women's paid labor supply reflect gender constraints more than those of men's paid labor supply. Age had the typical human capital effect (positive and diminishing), but education did not, perhaps because so much of the available work for women was unskilled. Marital status had a negative effect on women's labor supply (the opposite of its effect on men), and being previously married had a positive impact on women's paid labor shares. A woman worked less outside the home if her husband was older than she was, and she worked less if her husband had more education than she did. Husbands' wages had no impact on women's labor supply, refuting the notion that men's labor allocation in the home reflects price substitution.

Household characteristics had the expected impacts on women's paid labor supply (the same as the effects on men), except that the ratio of females to males in the home was a positive factor (it was not for men). This effect can be understood in two ways. First, the more women there were to share housework, the freer they were to pursue outside work. Second, once one woman had broken the cultural barrier against women working outside the home, it was easier for other women in the household to work as well.

V. Conclusions

The presence of the flower industry and other household and individual factors affected time use patterns in Ecuador in many surprising ways. The most compelling evidence of the industry's impact is on men's increased participation in housework. Married men in Cayambe spent twice as much time on housework as did men in Cotocachi, and this was clearly related to women's increased participation in the labor force. Employment in the flower industry was linked to even higher levels of men's time in housework. Even households in which the

wife did not work may have been affected. In those households married men did more housework than their counterparts in Cotocachi, but the difference was not statistically significant. Women in Cayambe did less housework than did women in Cotocachi.

The econometric results provide even stronger support for the argument that women's employment in the flower industry led to increases in men's housework through a bargaining effect. The findings that men's time in housework was not directly affected by wages, or by their wives' wages if they were married, and that wages were significant in the other labor allocation models together provide strong evidence against a wage substitution effect determining men's housework. The consistently positive effect of the Cayambe location dummy on men's housework makes the case instead that higher women's wages enabled women to bargain for a redistribution of housework in which men did more than they otherwise would have.

Large gender differences in time use were found independent of the effect of the flower sector. Men worked three-fourths of the time that women did when including housework, leaving women with much less leisure time than men. This is a fundamental inequity. Women in Cayambe did not work more total time in paid and unpaid, dispelling a frequent criticism of agricultural export development that maintains that women are unduly burdened by work in the industry. Women did spend more hours working than men, but this is apparently a result of their culturally assigned housework responsibilities and not a result of the availability of employment. There may be other reasons to criticize the flower industry, but the gender impacts are arguably positive on balance given that employment for women appears to lead to cultural change. By extension the trade liberalization policies that led to the growth in this employment should be recognized as an important component in the expansion of opportunities for women. As one woman in a focus group in Cayambe said, "Once a woman starts earning an income, she can set down her own conditions because she becomes more independent."

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