The Effect of Male Migration on Employment Patterns of Women in Nepal

Michael Lokshin and Elena Glinskaya

What is the impact of male migration on the labor market behavior of women in Nepal? The instrumental variable full information maximum likelihood method is applied to data from the 2004 Nepal Household Survey to account for unobserved factors that could simultaneously affect men's decision to migrate and women's decision to participate in the labor market. The results indicate that male migration has a negative impact on the level of the labor market participation by women in the migrant-sending household. There is evidence of substantial heterogeneity (based on both observable and unobservable characteristics) in the impact of male migration. The findings highlight the important gender dimension of the impact of predominantly male migration on the well-being of sending households. Strategies for economic development in Nepal should take into account such gender aspects of the migration dynamics. JEL codes: O15, J21

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A sharp increase in migration worldwide has fueled debate on the costs and benefits of international migration for sending communities (UNDP 2002). Remittances are considered a key means through which migration affects economic growth. Most microeconomic studies of migration and remittances focus on their role in reducing poverty and economic inequality. The impact of migration on the economic behavior of nonmigrating household members receives relatively little attention (Kanaiaupuni 2000).

Most research on the issue is sociological and demographic and finds that women spend more time working on home farms at least in part because of male migration (Crummet 1987; Deere and Leon de Leal 1987). Among the few economic studies of the labor market outcomes of members of households sending migrants, Funkhouser (1992) examines the effects of migration and remittances on the female labor market participation in Nicaragua. Itzigsohn

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(1995) assesses the effect of migrant remittances on the income and the labor market participation of members of low-income urban households in the Caribbean Basin. Rodriguez and Tiongson (2001) analyze the effect of migrants on the labor force participation of nonmigrants in the Philippines. Sadiqi and Ennaji (2004) study the impact of male migration from Morocco to Europe on the women left behind. Amuedo-Dorantes and Pozo (2006) and Hanson (2007) investigate how migration and migrant remittances affect the employment status and hours of work of others in the sending households in Mexico. Acosta (2006) looks at the relationships among remittances, labor supply, and school attendance in El Salvador. Cabegin (2006) and Yang (2008) examine the effect of overseas work-related migration on the market participation and labor supply behavior of spouses left behind in the Philippines. Kim (2007) studies the impact of remittances on labor supply in Jamaica. Görlich, Toman, and Trebesch (2007) consider the impact of migration on time allocation in migrant households in Moldova. The common finding of all these studies is that migration and remittances result in a decline in the labor force participation of household members left behind, in particular, of women.

This article examines the extent to which male migration affects the labor market participation of prime-age women in Nepal. This question is of interest for a country where 1 of 10 prime-age men works overseas and where in 2004 migrants sent back remittances valued at 17 percent of the GDP (World Bank 2005).

Work migration in Nepal, while predominantly a male phenomenon, occurs within a social framework. It affects families, households, and communities; changes the gender division of labor; and increases women's workload. Male migrants are gone for months and sometimes years at a time. When husbands are away, their wives not only continue to rear the children and take care of the usual household chores, but often also fill in for absent husbands on family plots or enterprises. Female heads of agricultural households have a particularly hard time when male labor is not available for tasks such as plowing, a taboo activity for women in certain areas of Nepal (Nandini 1999).

When men migrate, the well-being of sending households becomes increasingly dependent on the women, raising their status and strengthening their position in household decision-making. Women find themselves playing key roles as entrepreneurs in investing remittances or in running bazaar economies based on the sale of remittances in kind (Brown and Connell 1993). At the same time, however, social and traditional family norms and the structure of the Nepali labor market, which provides limited employment opportunities for women, reinforce husbands' objections to wives working away from home. Wives thus find it easier to work at home in order to maintain respectability in the eyes of neighbors and relatives.

This article models the household decisions on whether male household members are sent to migrate for work and then whether female household

members participate in labor market activities. Using data from the 2004 nationally representative survey of Nepali households, the full information maximum likelihood method is used to estimate the effect of male migration on the market participation of the women left behind. The method takes into account unobserved household characteristics that could simultaneously affect migration and decisions on the market participation. The results indicate that male migration has a negative impact on the level of the market participation by the women left behind.

This article contributes to the literature on the effects of migration and remittances in three important ways. First, this analysis is the only attempt known to the authors to estimate the impact of migration on the labor market behavior of household members of sending households in Nepal. Second, and new to this literature, a methodology is applied that controls for endogeneity and selection biases arising in the model. This econometric technique not only estimates the average effect of migration, but also shows for which types of women the effect of male migration matters more. Finally, the results highlight the important gender dimension of the predominantly male worker migration on the well-being of sending households.

The article is organized as follows. Section I describes the data and defines the main constructed variables. Section II presents the descriptive results, and section III discusses the theoretical model and the estimation methodology. The main findings are presented in section IV. Section V presents some policy implications of the findings.

I. Data

The data for this study are from the 2004 Round of the Nepal Living Standard Survey (NLSS-II), a nationally representative survey of households and communities conducted between April 2003 and April 2004 by the Nepal Central Bureau of Statistics, with assistance from the World Bank (Nepal Central Bureau of Statistics 2004). The sample frame used a two-stage method based on the 2001 Census (Nepal Central Bureau of Statistics 2003).[1] The NLSS collects data on the household consumption of a wide range of food and nonfood items; the sociodemographic composition of the household; the labor status, health, and education achievements of household members; and sources of household income, including income in kind and individual wages. Respondents also reported the amounts of any remittances their households received during the month of the survey and identified the age and migration destination of the remittance senders. This information was used to identify households with migrants.

The analysis here used a subsample of 3,528 households with information on 5,426 prime-age women (ages 18–60 years). The analysis focuses on the

1. For a detailed description of the sample frame and survey methodology, see World Bank (2005).

labor market behavior of these women, defining the labor market participation as engaging in wage-earning activities.[2] Data from the First Round of NLSS in 1996 and the Nepal Census of 2001 are used for the descriptive analysis and to construct the lagged indicators at ward and district levels.

Three groups of households could be misclassified under the definition based on the survey data. One group consists of households with migrants who are still in the process of establishing themselves or whose migrants bring rather than send the remittances home. The second group comprises households that do not report remittances because of fear of the tax consequences or for their own personal safety. The third group consists of households that receive remittances from nonhousehold members. Classifying these three groups of households as having no migrants would bias estimates of the impact of migration on household consumption.

To assess the extent of such misclassifications, the proportion of migrants in the total population from the 2001 Nepal Census was compared with the proportion of households with remittances in the NLSS data. The proportion of domestic migrants in the 2001 Census (4.8 percent) is statistically close to the proportion of migrants from households receiving domestic remittances in the NLSS (5 percent). The Census-calculated proportion of households with international migrants (14 percent) is lower than the NLSS proportion of household receiving remittances from abroad (18 percent). The official statistics report about 1 million prime-age men working outside Nepal. The equivalent NLSS figure is about 900,000. These relatively small discrepancies indicate that the bias resulting from misclassified households would most likely also be small.[3]

II. Migration and Female Labor Market Participation in Nepal

Migration has become a major factor in the economic development of Nepal over the last two decades. In 2004, close to 1 million Nepali migrants were working in India, countries of the Arab Gulf, South Asia, Western Europe, and North America. According to official sources, remittances to Nepali households from abroad reached $1 billion, overflowing foreign exchange reserves and affecting the exchange rate and inflation. Remittances coming through unofficial channels could be at least as large.

2. The focus is on female wage employment because an overwhelming majority of adult female respondents in the sample reported being self-employed in subsistence agriculture.

3. Households in which all members migrate together are omitted from the sample. The omission should have a negligible impact on the results. Kollmair and others (2006) show that only a small number of households migrate from Nepal to other countries and settle there. An analysis of the 2001 Nepal Census (Nepal Central Bureau of Statistics 2003) for this study indicates that only 1.78 percent of households changed their district of residence during the 5 years before the Census.

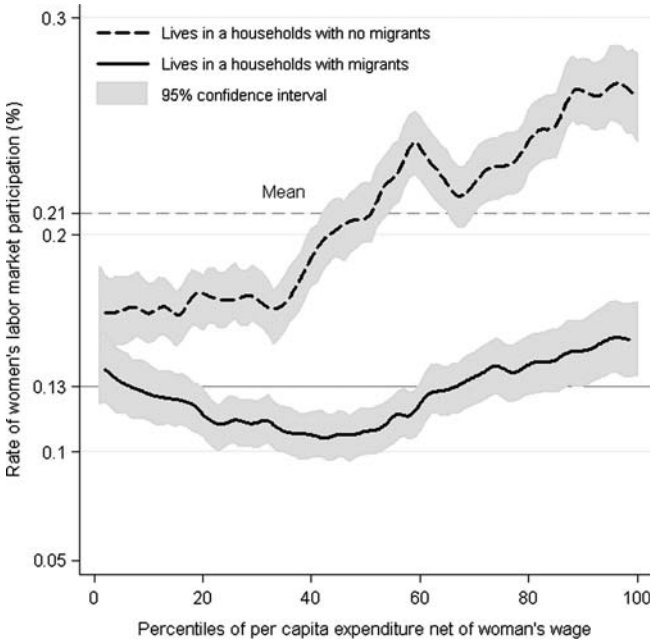
In 2004, 32 percent of households in Nepal had migrants and received remittances (World Bank 2005) averaging about 24,000 Nepal rupees in the year before the survey, or 16 percent of mean household yearly consumption. NLSS data reveal that almost all (97 percent) Nepali migrants are men, ages 15–44, and either the son or husband of the household members receiving the remittances.[4] Brothers make up about 10 percent of remittance donors. The propensity to migrate is higher among members of large households. Less than 2 percent of the households in the sample reported having two or more migrants. Most migrants come from rural areas. Only 13 percent of households in the capital city of Katmandu have migrants; more than twice as many do in rural areas. However, households in Katmandu and other urban areas receive remittances that average twice those received by rural households. The Newar and Janajati castes have the smallest proportions of households with migrants.

On average, 55 percent of men and 19 percent of women engaged in market wage-earning activities in 2004. Respondents, ages 20–35, made up the largest share of workers, with 58 percent of them men and 22 percent women engaged in wage-earning activities. Participation in market work declines with age for both men and women. The formal sector accounts for less than 8 percent of female employment in Nepal. More than 70 percent of female workers are self-employed or employed in low-wage activities in the informal sector. In urban areas, women are employed in a range of cottage industries—such as carpet-weaving, textiles, and handicrafts—and in occupations such as vending, petty trading, brewing, and vegetable selling (UNDP 2004). In rural Nepal, women often work as hired agricultural labor or manual labor in construction and forestry enterprises (Koolwal 2007). Nepalese women lag behind men in education attainment—the gap between male and female literacy rates is about 28 percentage points, and men receive almost twice as many years of schooling as women (World Bank 2005).

The level of market participation by prime-age women varied. On average, only 13 percent of women from households with migrants participated in the labor market, while 21 percent of women from households with no migrants did (figure 1). The gap between these two groups widened for households in the top percentiles of per capita expenditure net of women's market wages. Better-educated women had a higher propensity to work (figure 2). For all education categories except the highest, women from nonmigrant households had higher labor market participation rates. Participation was lowest among women with only 1–7 years of schooling.

4. The Nepal Foreign Employment Act of 1985 placed some restrictions on foreign work migration by women. It limited the overseas travel of single women, as well as women under age 35. The act prohibits the employment of women in foreign countries unless the women have permission from the Nepal government (Sanghera and Kapur 2000).

FIGURE 1. Rates of Women's Labor Market Participation by Percentiles of Per Capita Expenditure (Lowest regression)



Source: Authors' analysis based on data from Nepal Central Bureau of Statistics (2004).

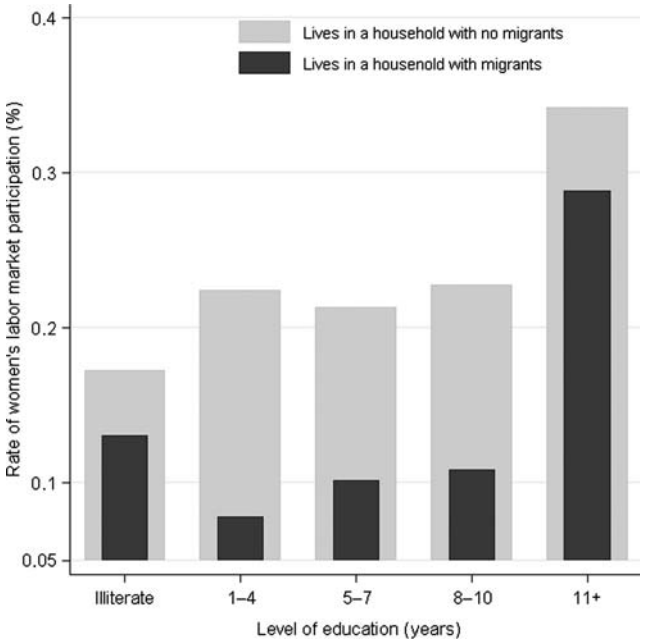
III. THEORETICAL FRAMEWORK AND EMPIRICAL STRATEGY

Before migration takes place, multiple arrangements need to be made. For international migration, for example, migrants have to obtain a passport, apply for a visa, and purchase a ticket. Costs include fees to the migration broker and travel costs, and often there is a contractual agreement between the migrant and the hiring agency (Bhatt and Bhattarai 2006). Thus, once the decision to migrate is made, reversing it can be costly for the household, so the worker usually has to migrate as planned.

Consider a two-period model of utility maximization by a household composed of a husband and wife.[5] Household utility depends on the leisure time of the spouses and the consumption of market goods and goods produced at home (Rosenzweig 1980). Spouses can allocate their time to leisure, market work, and home production. Assume, because of specialization, that the husband is more productive on the labor market and the wife is more productive at home. Assume also that the husband can earn a higher wage by migrating than in the domestic labor market. Under these assumptions, the husband always works on the market (at home or in another country) and the wife divides her time among home production, market work, and leisure.

5. The formal derivation of the theoretical model is available in Lokshin and Glinskaya (2008).

FIGURE 2. Years of Education by Females in Households With and Without Work Migrants



Source: Authors' analysis based on data from Nepal Central Bureau of Statistics (2004).

In period 1, the household compares its utility with and without migration, conditional on expected wages in period 2 (the actual wages in period 2 are unknown in period 1). The household decides that the husband will migrate if expected utility with migration exceeds expected utility without it. In period 2, the household observes the realized labor market outcomes: the migrant, now in the host country, informs the household about his wages, and wage conditions on the local market are known. With this information, the household decides whether the wife will participate in the labor market.

Standard testable hypotheses follow from this theoretical setup. A reduction in the costs of migration and higher expected returns from migration would be expected to increase the probability of the household choosing to send the migrant. The effect of the husband's migration on the wife's labor market behavior is determined by the interaction of income effects and the effect of changes in the wife's productivity at home caused by the migration of her husband. Remittances could be considered a source of household nonwage income. Following the standard assumptions of the theory of labor supply, an increase in nonwage income would raise the reservation wages of nonmigrating members of the household (Rosenzweig 1980). This, in turn, would have a disincentive effect on the wife's labor market participation.

If the inputs of spouses in home production are complements, the husband's migration would lower his wife's productivity at home.[6] In that case, the total effect of migration on the female labor market participation would be ambiguous: some women would enter the labor market and women who worked before their husbands migrated would work longer hours, while other women would spend more time on farm and household activities. If, however, the inputs of the husband and wife are substitutes, which is more likely in Nepal, where a large share of household production is in subsistence agriculture (Kniesner 1976; Leeds and von Allmen 2004), the husband's migration would make the wife's work at home more valuable, so she would reduce her participation in the labor market (Paris and others 2005). Some women would withdraw completely from labor market work. In those cases, lower levels of the market participation would be expected among women in sending households.[7]

The theoretical framework and empirical estimations do not differentiate between internal and international migrations. The impact of both types of migration on the labor market behavior of sending households should be similar and is transferred through two main channels: productive members leave their households, and remittances are transferred within a country or between countries. At the same time, an econometric model that would estimate the three-destination migration decision simultaneously with the market participation decisions of women left behind appears to be computationally infeasible in the full information maximum likelihood framework. Splitting migrant households into two groups would also create a small sample size problem.

Empirical Specification

Let the husband's propensity to migrate be expressed in linearized form as:

$$M_i^* = \gamma \mathbf{Z}_i + \mu_i \tag{1}$$

where subscript i denotes the individual, γ is a vector of parameters; $\mathbf{Z}_i$ is a vector that includes variables on the productive characteristics of a husband and a wife, household characteristics, local labor market characteristics, and the variables determining cost of migration; and μ_i is an error term. Then, the

6. Hiring a perfect substitute for the labor of a husband who migrates is assumed to be very costly to households (Pfeiffer and Taylor 2007).

7. Another channel through which remittances might affect the household labor supply is the removal of liquidity constraints. Remittances might allow liquidity-constrained households to open their own business, which will lead to an increase in household labor supply. There is also a theoretical possibility that access to the labor market differs across households where there are labor market rigidities or household restrictions to off-farm employment for women (such as a religious taboo; see, for example, Rodriguez and Tiongson 2001). Then, the migration decision can be affected by the labor supply of household members.

observed migration status of husband M_i can be expressed as:

$$M_i = 1[M_i^* \geq 0] = 1[\gamma Z_i + \mu_i \geq 0] \tag{2}$$

where 1[.] is an indicator function. The number of hours a wife spends on the labor market could be expressed in a linearized form as:

$$h_{ij} = \beta_j \mathbf{X}_i + \nu_{ij}, \quad j = 0, 1 \tag{3}$$

where β_j is a regime-specific vector of parameters; $\boldsymbol{X_i}$ is a vector of the individual characteristics of a wife, household characteristics, and locale characteristics; ν_{ij} is the regime-specific error term; and subscript j denotes the regimes (migrate/do not migrate).

Let R_{ij} be the observed labor market status of a wife in period 2, such that:

$$R_{ij} = 1[h_{ij} \geq 0] = 1[\beta_j \mathbf{X}_i + \nu_{ij} \geq 0], \quad j = 0, 1. \tag{4}$$

Error terms (μ_i, ν_{i0}, ν_{i1}) in equations (2) and (4) are assumed to be jointly normally distributed with a zero-mean vector and correlation matrix:

$$\Omega = \begin{pmatrix} 1 & \rho_{\mu 0} & \rho_{\mu 1} \\ & 1 & \rho_{01} \\ & & 1 \end{pmatrix} \tag{5}$$

where the $\rho_{\mu 0,1}$ terms are the correlations between ν_0, ν_1, and μ, and where ρ_{01} is the correlation between ν_0 and ν_1. Since R_{i1} and R_{i0} are never observed simultaneously, the joint distribution of (ν_0, ν_1) is not identified, and consequently ρ_{01} cannot be estimated. Then, the log-likelihood function for the simultaneous system of equations (2) and (4) is:

$$\begin{aligned} \mathrm{Ln}(\Im) = & \sum_{M_i \neq 0, R_i \neq 0} \ln\{\Phi_2(\mathbf{X}_i\beta_1, \mathbf{Z}_i\gamma, \rho_{\mu 1})\} + \sum_{M_i \neq 0, W_i = 0} \ln\{\Phi_2(-\mathbf{X}_i\beta_1, \mathbf{Z}_i\gamma, -\rho_{\mu 1})\} \\ & + \sum_{M_i = 0, R_i \neq 0} \ln\{\Phi_2(\mathbf{X}_i\beta_0, -\mathbf{Z}_i\gamma, -\rho_{\mu 0})\} + \sum_{M_i = 0, R_i = 0} \ln\{\Phi_2(-\mathbf{X}_i\beta_0, -\mathbf{Z}_i\gamma, \rho_{\mu 0})\} \end{aligned} \tag{6}$$

where Φ_2 is the cumulative function of a bivariate normal distribution.

This switching probit model in equation (6) (see, for example, Carrasco 2001; Cappellari 2002) can be used to generate the counterfactual probabilities for women in different regimes of migration and the labor market participation. The impact of migration on women's labor market participation is defined as a treatment effect, following the methodological framework developed by Aakvik, Heckman, and Vytlacil (2000). Then, the effect of migration on a working woman with characteristics x in sending households can be

interpreted as the effect of treatment on the treated (TT):

$$\begin{aligned} \mathrm{TT}(x) &= \Pr[R_1 = 1 | M = 1, \mathbf{X} = x] - \Pr[R_0 = 1 | M = 1, \mathbf{X} = x] \\ &= \frac{\Phi_2[\mathbf{X}\beta_1, \mathbf{Z}\gamma, \rho_{\mu 1}] - \Phi_2[\mathbf{X}\beta_0, \mathbf{Z}\gamma, \rho_{\mu 0}]}{F[\mathbf{Z}\gamma]} \end{aligned} \tag{7}$$

where F is the cumulative function of a univariate normal distribution. The TT is the difference between the predicted probability of the labor market participation for a woman currently residing in a household with a migrant and the probability of the labor market participation for that woman had the household decided not to send a migrant. The average treatment effect on the treated (ATT) is obtained from equation (7) by averaging $\mathrm{TT}(x)$ over the sample of women residing in households with migrants:

$$\mathrm{ATT} = \frac{1}{N_{M=1}} \sum_{M=1} \mathrm{TT}(x_i) \tag{8}$$

while the ATT for a subgroup of the population is an average of $\mathrm{TT}(x)$ for that subgroup (Heckman and Vytlacil 2000, 2005), for example:

$$\mathrm{ATT}(\text{Kathmandu}) = \frac{1}{n_k} \sum_{i=1}^{n_k} \mathrm{TT}(x_i) \tag{9}$$

where n_k is the number of households with a migrant that reside in Katmandu.

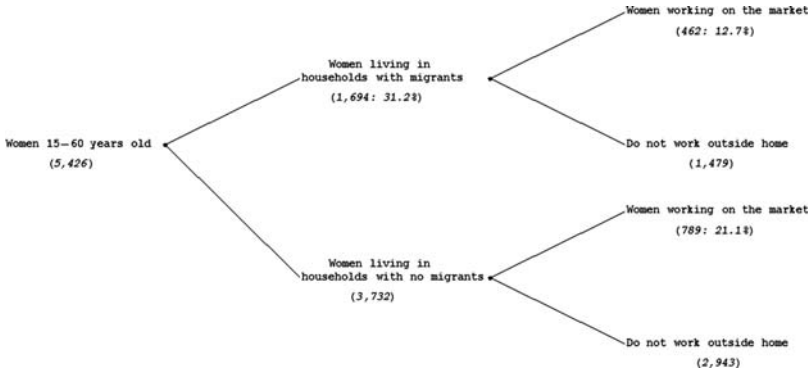
The effect of male migration on the probability of the market participation for a woman randomly drawn from the population of women with characteristics x can be expressed as the treatment effect (TE):

$$\mathrm{TE}(x) = \Pr[R = 1 | \mathbf{X} = x] - \Pr[R = 0 | \mathbf{X} = x] = F[\mathbf{X}\beta_1] - F[\mathbf{X}\beta_0]. \tag{10}$$

Similar to equation (8), the average treatment effect (ATE) is a sample average of $\mathrm{TE}(x)$.

The effect of male migration on the female market participation can vary by observed household characteristics $\mathbf{X}$ and unobserved characteristics μ. To account for the unobserved heterogeneity, the marginal treatment effect (MTE) is estimated, using the framework introduced by Bjorklund and Moffitt (1987) and developed by Heckman and Vytlacil (1999, 2000, 2001, 2005). The MTE identifies the effect of male migration on households induced to change the working status of female members because of migration. The MTE can be

FIGURE 3. Sample Selection Diagram (Number of observations and percentage of the sample in groups)



Source: Authors' analysis based on data from Nepal Central Bureau of Statistics (2004).

expressed as:

$$\begin{aligned} \text{MTE}(x,\mu) &= \Pr[R_1 = 1|\mathbf{X} = x, \mu = \bar{\mu}] - \Pr[R_0 = 1|\mathbf{X} = x, \mu = \bar{\mu}] \\ &= F\left[\frac{\mathbf{X}\beta_1 + \rho_{\mu 1}\bar{\mu}}{\sqrt{1-\rho_{\mu 1}^2}}\right] - F\left[\frac{\mathbf{X}\beta_0 + \rho_{\mu 0}\bar{\mu}}{\sqrt{1-\rho_{\mu 0}^2}}\right]. \end{aligned} \tag{11}$$

The schematic diagram of the switching probit model of male migration and the female market participation is shown in figure 3.[8]

The literature on estimating the impact of male migration on the female labor market participation uses three main econometric techniques: instrumental variable regressions, bivariate probit estimators, and matching type estimators. The advantage of the matching estimator is that it requires no assumptions about the distribution of the error terms in equations (1)–(4). The matching estimators assume that the heterogeneity of the effects of migration could be captured by controlling for observable characteristics. The theoretical model indicates that both the husband's migration decision and the wife's labor market participation decision depend on unobservable (by the researcher) characteristics, such as the properties of the home production function.

Both the instrumental variable regression and the bivariate probit estimation rely on normality assumptions, as does the switching probit method used here. However, the switching probit method has several advantages: it relaxes the assumption of equality of coefficients of the labor market participation equations in two regimes and thus is more efficient than either the instrumental variable regression or the bivariate probit estimation. The instrumental variable

8. The likelihood function (equation 6) and the corresponding treatment effect are estimated with Stata command switch_probit (Lokshin and Sajaia forthcoming).

regression, when applied to estimation of the binary choice models with binary endogenous regressors, performs well only in cases of approximately equal probabilities of binary groups; in the analysis here, the proportions of working women and of households with migrants are quite low (Altonji, Elder, and Taber 2005). Finally, the switching probit framework permits defining the effect of male migration on the female labor market participation in terms of impact evaluation and, in particular, enables measuring the ATT and MTE. The instrumental variable estimation can recover only the local treatment effect (Angrist 1991).

Identification Strategy

The system of equations (2) and (4) is identified by nonlinearities even if the variables in **X** and **Z** overlap completely. To make the estimates more robust to alternative functional assumptions, stronger identification restrictions are imposed on the model by including variables that are believed to influence the household's migration decision but not to directly affect the labor market participation decision.

Information from the 2001 Nepal Census (Nepal Central Bureau of Statistics 2003) is used to construct two instrumental variables: the proportion of internal and international migrants in a ward (village) in 2001. In Nepal, labor markets are segmented by gender, and the rates of female employment are only marginally affected by changes in labor market conditions for men (Acharya 2003; Bhatt and Bhattarai 2006). Thus, women's decisions to participate in the labor market in 2004, after controlling for current conditions on the local labor market, should not be directly affected by migration networks formed as early as the 19th century.

Historically, the extent of migrant networks differs by regions in Nepal. In the early 19th century, Gorkhas from the northern hills of Nepal migrated to cities like Lahore in Pakistan, and joined the Indian and British armies. In the 1920s and 1930s, mountain people from the Solu Khumbu area of Nepal migrated to Darjeeling, India, where they were employed as porters. The development of the tea estates in northern India in the early 20th century attracted migrants from southern Nepal (Seddon, Jagannath, and Gurung 2001). Migration from these regions was determined by factors exogenous to local economic conditions.

For this study, the proportion of migrants in a ward in 2001 was used as a proxy for the ward-level networks that help new migrants (see Carringon, Detragiache, and Vishwanath 1996; Munshi 2003). On arrival in the host country, Nepali migrants develop extensive social and information networks that link them with relatives and friends in the home country (Yamanaka 2000). Such networks lower the cost of migration for others in the same wards. Nepali migrants tend to follow their co-villagers and migrate to the same destinations (Thieme 2005). They are also likely to fill a similar niche in the labor market of the country to which they migrate. Woodruff and Zenteno (2007)

and McKenzie and Rapoport (2005) applied the identification strategies that use migrant networks as instruments for migration decisions in studies of migration in Mexico.

The instruments used here could be criticized on the grounds that some lagged ward-level unobserved characteristics can be correlated with the female labor market participation. It would be preferable to use information on older networks, but such data are not available. This criticism is addressed by including in the empirical model a wide set of ward characteristics. Nevertheless, given the limitations of the data, it cannot be established with certainty that the instruments capture no unobserved characteristics of wards that are correlated with labor market outcomes. To some degree, the identification of the system used here comes from functional form assumptions. While the instruments used have these potential weaknesses, they are at least as valid as those used in previous studies. Several diagnostics tests are used to ascertain the validity of the instruments.

Explanatory Variables

The explanatory variables in this model contain the characteristics that determine a woman's market productivity: age (experience) and education-level dummy variables; variables that could affect the home productivity of household members, such as demographic composition and the size of the household's plot; variables describing ethnicity, religion, and household nonwage income;[9] and variables describing regional and ward characteristics, including labor market conditions, distance from the Indian border, and poverty and inequality.

The descriptive statistics for the main explanatory variables are reported in table 1. The characteristics are similar for women living in migrant-sending and nonsending households, with some differences—for example, women in nonsending households are better educated. Migrant-sending households are, on average, smaller, have a higher share of men (adjusted for the number of current migrants), possess larger land plots, and have higher nonwage incomes than do nonsending households. Women working in the labor market are better educated, less likely to be married, and reside in smaller households, with smaller proportions of women, than do women not working in the labor market. Compared with other castes, Brahmin, Chhetri, and Newar households are less likely to have women participating in the labor market. Land ownership has a strong negative effect on the probability of a woman participating in the labor market: women living in landless households are almost three times more likely to work for wages than women in households with less than 1 hectare of land. The gap is

9. Nonwage income is defined as the sum of all government and private transfers, such as, pensions and scholarships, that are exogenous to household migration and labor force participation decisions; it excludes interhousehold transfers, donations, and other private transfers that may respond to the household's migration and labor supply decisions. An alternative approach, following Blundell and Macurdy (1999), would be to include in the empirical specification the household expenditure instrumented with nonwage income.

TABLE 1. Descriptive Statistics for the Main Variables

	Women from household with migrants		Women from household without migrants		Women participating in labor market		Women not participating in labor market	
Variable	Mean	Standard error	Mean	Standard error	Mean	Standard error	Mean	Standard error
Participate in wage work	0.127	0.008	0.211	0.007				
Live in household with migrants					0.214	0.412	0.335	0.472
Women's characteristics								
Age	34.542	12.825	34.521	11.799	34.045	10.565	34.637	12.453
Married	0.806	0.010	0.812	0.006	0.782	0.013	0.817	0.006
Illiterate	0.614	0.012	0.612	0.008	0.537	0.016	0.630	0.007
1–4 years of schooling	0.100	0.007	0.102	0.005	0.109	0.010	0.100	0.005
5–7 years of schooling	0.099	0.007	0.084	0.005	0.090	0.009	0.089	0.004
8–10 years of schooling	0.152	0.009	0.135	0.006	0.159	0.012	0.136	0.005
11+ years of schooling	0.035	0.004	0.066	0.004	0.106	0.010	0.045	0.003
Household characteristics								
Household size	5.835	2.952	6.267	3.189	5.536	2.537	6.268	3.226
Share of adult men	0.325	0.003	0.277	0.002	0.282	0.005	0.294	0.002
Share of elderly	0.320	0.003	0.337	0.002	0.347	0.005	0.328	0.002
Share of women	0.152	0.003	0.157	0.003	0.137	0.005	0.160	0.002
Share of children ages 0–6	0.165	0.004	0.192	0.003	0.199	0.006	0.180	0.003
Share of children ages 7–15	0.033	0.002	0.036	0.001	0.033	0.003	0.036	0.001
Male-headed household	0.643	0.012	0.903	0.005	0.779	0.013	0.831	0.006
Landless households	0.372	0.012	0.471	0.008	0.694	0.015	0.383	0.007
Own less than 1 hectare	0.377	0.012	0.314	0.008	0.234	0.013	0.357	0.007
Own 1–2 hectares	0.159	0.009	0.141	0.006	0.050	0.007	0.169	0.006
Own more than 2 hectares	0.091	0.007	0.073	0.004	0.022	0.005	0.092	0.004

Household ethnicity and nonwage income								
Brahman/Chhetri	0.355	0.012	0.285	0.007	0.212	0.013	0.329	0.007
Dalits	0.084	0.007	0.068	0.004	0.074	0.008	0.072	0.004
Newar	0.065	0.006	0.150	0.006	0.233	0.013	0.098	0.004
Terai Madhesi Caste	0.255	0.011	0.247	0.007	0.210	0.013	0.259	0.007
Muslim, other	0.241	0.010	0.250	0.007	0.271	0.014	0.242	0.006
Hindu	0.829	0.009	0.817	0.006	0.808	0.012	0.824	0.006
Household nonwage income	0.609	4.585	0.508	3.065	0.305	1.708	0.593	3.912
Regional and ward characteristics								
Katmandu	0.038	0.007	0.144	0.004	0.226	0.005	0.082	0.004
Other urban areas	0.185	0.009	0.187	0.006	0.221	0.013	0.178	0.006
Rural Western Hills	0.239	0.010	0.150	0.006	0.097	0.009	0.196	0.006
Rural Eastern Hills	0.169	0.009	0.193	0.006	0.148	0.011	0.194	0.006
Rural Western Terai	0.117	0.008	0.118	0.005	0.064	0.008	0.130	0.005
Rural Eastern Terai	0.250	0.011	0.208	0.007	0.244	0.014	0.216	0.006
Percentage of migrant population	0.139	0.004	0.091	0.002	0.091	0.004	0.109	0.002
Number of observations	1,694		3,732		1,004		4,422	

Source: Authors' analysis based on data from Nepal Central Bureau of Statistics (2004).

even larger between women in landless households and those in households that own larger land plots. Women living in Katmandu and other urban areas of Nepal are more likely to work for wages than are women in rural areas.

IV. Results

In the joint estimation of equations (2) and (4),[10] the coefficients on the main explanatory variables affecting household migration and woman's labor market participation decisions correspond well with the predictions of the theoretical model (table 2). Households in wards with higher proportions of migrants in 2001 were more likely to send their male members to migrate for work.

Overall, the observed household characteristics, particularly the geographic and ward characteristics, are more important in determining the level of the labor market participation of women in nonmigrant-sending households than of women in migrant-sending households. While a household's human and productive capitals have a strong effect on women's labor market participation in households without migrants, these factors become less important for households that have sent migrants (where remittances contribute a significant share to the household budget).

The level of market participation increases with age for women in both sending and nonsending households. Married women and women with 11 or more years of education are more likely to work for wages. Household nonwage income negatively affects the likelihood of market employment of women from nonsending households. The effect of nonwage income on the market participation of women in sending households is insignificant. Household demographic composition seems to affect the market participation of women in nonsending households. Relative to other ethnic groups, women in Dalit and Muslim households have a higher probability of working. These results are consistent with those of other studies that demonstrate that Hindu women in Indo-Aryan communities that are disposed toward patriarchy are less likely to work for pay than women in primarily Buddhists, Tibeto-Burman, and Muslim communities, which offer women greater social and economic mobility (Raghuram 2001; Koolwal 2007). Women in households with large plots are less likely than those in households with small or no plots to work

10. By the likelihood-ratio (LR) test criterion, the specification that assumes independence of the error terms in equations (2) and (4) (see Lokshin and Glinskaya 2008 for details) is rejected in favor of the full information maximum likelihood estimation.
The Wald tests show that the estimated $\rho_{\mu 0}$ is statistically significant with ($\chi^2(1) = 4.03$), and $\rho_{\mu 1}$ is statistically significant with ($\chi^2(1) = 3.88$); two ρ's are jointly significant.
The LR test on the equality of the coefficients in the equations determining the female market participation in sending and nonsending households rejects the null hypothesis that the effects of the regressors on the female market participation are the same in both regimes ($\chi^2(31) = 54.95$; $\Pr > \chi^2 = 0.0051$).

TABLE 2. Full Information Maximum Likelihood Estimation of the Endogenous Switching Probit Model

	Women's labor market participation decision					
	Households with no migrant		Households with migrant		Migration decision	
Variable	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Women's characteristics						
Age and marital status						
Age	0.063***	0.017	0.113***	0.031	−0.042***	0.013
Age squared/100	−0.092***	0.022	−0.155***	0.041	0.053***	0.017
Married	−0.090	0.080	−0.373***	0.137	0.202***	0.064
Education (reference: illiterate)						
1–4 years of schooling	0.107	0.085	−0.290*	0.172	0.005	0.071
5–7 years of schooling	0.012	0.094	0.088	0.168	0.071	0.075
8–10 years of schooling	0.070	0.085	0.019	0.166	0.149**	0.072
11+ years of schooling	0.321***	0.119	0.830***	0.267	0.026	0.120
Currently in school	−0.437***	0.142	−0.791***	0.306	0.035	0.119
Household characteristics						
Household size	0.007	0.030	0.068	0.084	−0.082***	0.022
Household size squared	−0.000	0.001	−0.004	0.005	0.002**	0.001
Share of adult men	0.120	0.327	−0.601	0.830	−1.041***	0.256
Share of elderly	1.685***	0.426	0.839	1.903	−4.700***	0.244
Share of women	0.487	0.297	−0.100	1.019	−2.503***	0.186
Share of children ages 0–6	1.099***	0.262	0.025	1.010	−2.449***	0.173
Share of children ages 7–15	0.074	0.169	0.081	0.554	−1.468***	0.059
Male-headed household	−0.242***	0.093	−0.440	0.297	0.690***	0.067
Land ownership (reference: landless households)						
Own less than 1 hectare	−0.425***	0.079	−0.684***	0.126	0.021	0.065
Own 1–2 hectares	−0.822***	0.111	−1.137***	0.200	−0.003	0.078
Own more than 2 hectares	−1.101***	0.155	−0.859***	0.219	0.193**	0.094
Household nonwage income and ethnicity income						
Household nonwage income	−0.051***	0.014	−0.016	0.017	0.002	0.005

(Continued)

TABLE 2. Continued

	Women's labor market participation decision					
	Households with no migrant		Households with migrant		Migration decision	
Variable	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Ethnicity (reference: Brahman/Chhetri)						
Dalit	0.229**	0.108	0.398**	0.167	−0.095	0.083
Newar	0.484***	0.088	0.499***	0.186	−0.256***	0.085
Terai Madhesi Caste	0.406***	0.080	0.207	0.140	−0.116**	0.059
Muslim, other	0.281***	0.082	0.361**	0.144	−0.143**	0.062
Hindu	0.020	0.069	0.252*	0.133	−0.109*	0.058
Regional and ward characteristics						
Regional dummy variables (reference: Kathmandu)						
Other urban areas	−0.105	0.127	0.282	0.444	0.777***	0.119
Rural Western Hills	0.002	0.164	0.573	0.544	0.813***	0.147
Rural Eastern Hills	0.399***	0.145	0.928**	0.433	0.593***	0.135
Rural Western Terai	0.123	0.174	0.967*	0.500	0.706***	0.150
Rural Eastern Terai	0.508***	0.171	1.210**	0.553	0.930***	0.141
Ward characteristics						
Percent illiterate	−1.083***	0.183	−0.880***	0.296	0.161	0.136
Percent in wage employment	1.539***	0.310	0.475	0.522	0.204	0.243
Percent self-employed	0.506**	0.221	−0.080	0.367	0.465***	0.151
Ward inequality (Gini)	0.537	0.452	−0.904	0.777	−0.769**	0.336
Ward poverty rate	0.049	0.103	0.095	0.191	0.118	0.082
Distance to India	−0.013	0.043	0.151**	0.074	−0.019	0.033
Percent of international migrants					0.863***	0.155
Percent of domestic migrants					0.213	0.238
Constant	−3.425***	1.019	−3.983**	1.737	1.878**	0.803
Number of observations	5,426					
Log-likelihood	−4847.91					

*Significant at the 10 percent level; **significant at the 5 percent level; ***significant at the 1 percent level.

Note: The standard errors are adjusted for clustering on a ward level.

Source: Authors' analysis based on data from Nepal Central Bureau of Statistics (2004).

outside the home, regardless of the migration decisions of male household members, likely because economies of scale in agriculture increase women's productivity when they work on larger plots. Compared with women living in Katmandu, women residing in other urban areas of Nepal and in rural Western Terai have a lower propensity to participate in market work.

Finally, certain local conditions are significantly correlated with levels of women's market participation. Women in nonmigrant households living in wards with a high proportion of illiteracy are significantly less likely to participate in market work than are women in wards with better-educated populations. Higher shares of wage and self-employment in a ward have a positive impact on women's labor market participation in households with no migrants. The effects of local labor market conditions on the market participation of women residing in migrant-sending households are insignificant.

Various diagnostic tests were run to determine the validity of the instruments. The Sargan's (1958) test on a linearized form (linear instrumental variable regression) of the system of equations (2)–(4) confirms that the excluded instruments are uncorrelated with the error terms ($\Pr > \chi^2(1) = 0.353$) and correctly excluded from equation (4). The test proposed by Stock and Yogo (2005) was used to investigate the potential of a weak instruments problem. The Cragg–Donald (CD) Wald *F*-statistic was calculated by regressing a woman's market participation on a set of her characteristics, an instrumental variable, and an endogenous dummy variable for having a migrant from the household. The hypothesis of weak instruments was rejected with a CD *F*-statistic of 20.39 and critical values of the Stock–Yogo test of 19.93 for 10 percent size of the Wald test. The Wald test on the joint significance of the excluded instruments of $\chi^2(2) = 28.86$ could be interpreted as further evidence for rejecting the weak instruments hypothesis. Finally, a "naïve" test of the validity of the instruments was conducted by including instruments in the labor market participation decision equations. This estimation, identified through nonlinearity, shows that both instruments are insignificant in the labor market participation decision equation and significant in the migration decision equation.

Simulations

The impact of male migration on women's labor market participation was simulated according to equations (7)–(10). Women living in migrant-sending households had a 5.3 percentage point (bootstrap standard error of 1.7) lower probability of participating in the labor market compared with the counterfactual scenario of women living in nonsending households; this is the ATT. The effect of male work-related migration on the market participation of a woman randomly selected from the population was positive and statistically not different from zero; this is the ATE. By comparison, the raw difference in rates of the market participation was −8.4 (standard error of 1.1; ($\Pr(W_1$ |

$M = 1) - \Pr(W_0 \mid M = 0) = -8.4)$), suggesting that controlling for selection appeared to be important in these data.

Next, the results of these simulations are compared with the results from the estimation techniques used in the literature on the effect of migration on the labor market participation of women left behind.[11] For the specification that included the migration dummy variable directly in the market participation equation, the ATT is −4.8 percentage points (standard error of 1.8). The magnitude of these effects is similar to that found by Kim (2007) for Jamaica. The bivariate probit of the migration and market participation equations was estimated replicating the methodology of Görlich, Toman, and Trebesch (2007), which uses the same set of explanatory variables and instruments as the preferred model here. This specification assumes joint normality of error terms in the migration and market participation equations and, compared with the switching probit model, imposes a restriction of the equality of coefficients in the market participation equation (4) for women in households with a male migrant and for those in households without a migrant. The derived ATT indicates that, relative to the counterfactual scenario of no migration, women in households with migrants are 5.2 (standard error of 1.1) percentage points less likely to participate in work outside the home. Finally, a propensity score matching technique similar to that of Esquivel and Huerta-Pineda (2006), which assumes selection on observables only, results in a −7.5 percentage point reduction in the market participation of women in households with migrants.

These results are consistent with those from methods used in previous studies. This could boost confidence in the findings of these other studies. Or the similarity of the results across methods could indicate that the full information maximum likelihood model is as biased as the other approaches and was not able to solve the selection issues that plague the migration literature. But the theoretical arguments in favor of the identification strategy, the empirical tests of the validity of the instruments, and the robustness of the results to different econometric specifications and assumptions increase the confidence in the estimates presented here of the impact of male migration on women's labor market participation.

The heterogeneity of the effect of male migration on the female market participation can also be simulated by observable characteristics, as in equation (10). These simulations are shown in the first column of table 3. The largest negative impact of male migration is on women ages 25–35, whose level of the labor market participation would rise by 6.5 percentage points if male migrants were to stay at home. The dampening effect of male migration on the female market participation increases with a woman's education. The market participation by women with 11 or more years of schooling is 15.3 percentage points lower than it would be in the counterfactual scenario. Male migration

11. The complete set of results for these estimations is available in Lokshin and Glinskaya (2008).

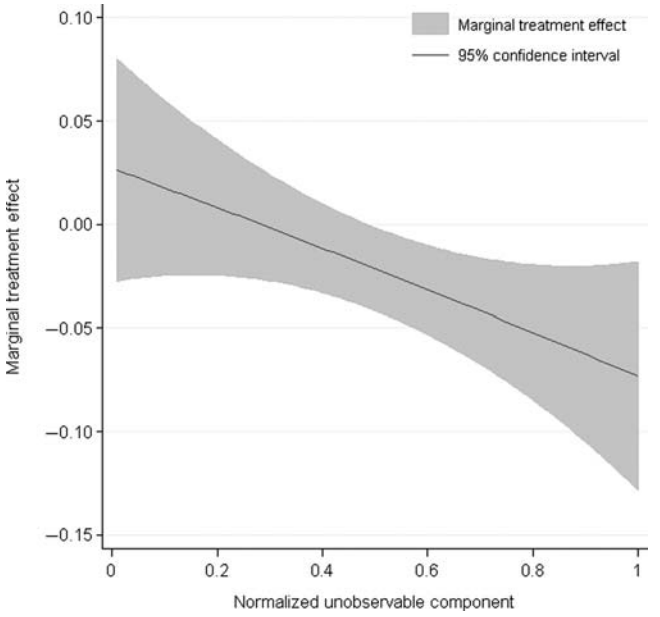
TABLE 3. Simulated Effect of Migration on Women's Labor Market Participation in Migrant-Sending Households (by characteristics of women and households)

	Average treatment effect on the treated (ATT)		Average treatment effect (ATE)	
Variable	Estimate	Standard error	Estimate	Standard error
Age				
18–25	−5.495	1.719	2.127	3.931
25–35	−6.507	2.504	2.354	4.511
35–45	−3.475	1.739	4.178	3.831
45–60	−1.417	1.922	2.502	3.638
Education				
Illiterate	−5.495	1.719	2.127	3.931
1–4 years of schooling	−6.507	2.504	2.354	4.511
5–7 years of schooling	−3.475	1.739	4.178	3.831
8–10 years of schooling	−1.417	1.922	2.502	3.638
11+ years of schooling	−15.313	5.573	9.388	8.760
Landholding				
Landless	−9.236	3.131	4.991	5.799
Own less than 1 hectare	−3.465	1.740	1.239	3.573
Own 1–2 hectares	−2.904	1.204	0.252	2.666
Own more than 2 hectares	−2.302	1.533	3.736	3.125
Ethnicity				
Brahman/Chhetri	−2.499	1.509	2.897	3.476
Dalit	−1.676	2.660	6.894	4.839
Newar	−17.818	4.240	2.606	7.067
Terai Madhesi Caste	−7.270	2.290	−0.722	4.409
Muslim, other	−5.787	2.499	4.620	4.447
Region and ward				
Katmandu	−19.353	5.941	−4.879	9.294
Other urban areas	−9.496	2.886	2.700	5.837
Rural Western Hills	−0.647	1.350	2.582	3.326
Rural Eastern Hills	−6.366	2.070	1.257	4.002
Rural Western Terai	−1.360	2.091	4.864	3.932
Rural Eastern Terai	−4.950	2.493	3.961	4.342
Total	−5.319	1.874	0.061	4.899

Note: The standard errors of the predicted probabilities are calculated by bootstrapping.
Source: Authors' analysis based on data from Nepal Central Bureau of Statistics (2004).

has a greater impact on the work participation of women residing in Katmandu and other urban areas of Nepal and of women living in landless households than it does on that of women living in rural areas or in households with large land holdings. Such differences might be explained by differences in the technology of home production. In households with large plots, women might be able to substitute, to some extent, hired labor for the inputs of men who have migrated, thus lowering the impact of male migration on their productivity at home. The home production of landless households is likely to be

FIGURE 4. Heterogeneity in the Effect of Migration on Women's Labor Market Participation by Unobserved Component (Estimated MTE at population means)



Source: Authors' analysis based on data from Nepal Central Bureau of Statistics (2004).

related to child-rearing and the tending of elderly household members—activities for which finding a paid substitute is difficult.

Heterogeneity in the effect of migration based on unobservable characteristics can be investigated using the MTE framework. Figure 4 plots the MTE against the normalized values of unobservables (μ) at the population means for **X**'s according to equation (11). The estimate of MTE is monotonically decreasing in μ, indicating that households that are more likely to send a male member to migrate for work are also more likely to withdraw their female members from the labor market. The fact that the MTE is not flat confirms the presence of unobservable heterogeneity in the impact of migration on women's labor market participation.[12]

The estimated correlations of error terms in equations (2) and (4) demonstrate the perverse selection on unobservable characteristics: for households sending migrants, unobservable characteristics that positively affect the probability of sending a migrant for work have a negative impact on the probability of a woman's participating in the labor market ($\text{Corr}(\mu, \nu_1) = -0.290$). At the same time, for households with no migrants, the unobservable characteristics

12. The structure of the MTE is determined, to a large extent, by the normality assumptions imposed on the error structure of the empirical model.

promoting migration are positively correlated with women's employment ($\text{Corr}(\mu, \nu_0) = -0.256$). Thus, higher values of μ are correlated with lower value of ν_1 and with higher values of ν_0, so that the impact of male migration on women's labor force participation is lower for households with high μ (who are more likely to have a working migrant).

Qualifications

There are several qualifications concerning the results of this study. First, the results were obtained using cross-sectional data of the year 2004. Without panel data, there are no instruments to control for possible household- or community-level endogeneity. In this sense, the estimations of the impact of work-related migration are valid only to the extent that the variables included in the empirical specification capture unobserved family and community characteristics. Second, the effect of male migration might differ with the relationship of the migrant (husbands, fathers, brothers, other relative) to the women of the sending households. The analysis fails to capture this heterogeneity. Finally, the analysis looks only at the direct impact of male migration on the labor market behavior of women in sending households. Male migration for work could also affect aggregate labor market conditions in the sending communities. Accounting for the general equilibrium consequences of work-related migration might reduce its estimated impact on the labor market participation of women in the household.

V. Conclusion

This article examined the extent to which male migration affects the labor force participation of prime-age women in migrant-sending households in Nepal, using nationally representative household survey data. The theoretical model developed here predicts that male migration could have two main effects on the labor market participation of women. First, the increase in household income from remittances could lead to a reduction in the labor market participation by women. Second, depending on the properties of the home production function, male migration could increase or decrease women's home productivity, thus having an ambiguous effect on their labor market participation. The overall effect of male migration on women's labor market participation therefore depends on the interaction of these factors. The article compared the observed rates of the labor market participation of women in households that had sent migrants with simulated rates under a counterfactual scenario of no migration. To construct these counterfactuals, a model of household male migration and the female labor market participation decisions was estimated that identified observed and unobserved differences in the returns to characteristics based on migration status.

The migration of male household members was found to reduce women's rates of labor market participation by 5.3 percentage points. The effect was

strongest for women ages 25–35 and for women with 11 or more years of education. The income effect of remittances from migrants and the substitutability of male and female time inputs in home production might explain the stronger impact of male migration on women residing in landless households and in urban areas of Nepal. The effect of male migration on the labor market participation of women living in households with large landholdings is weaker, suggesting that men and women in these households complement each other in home production. There is evidence of substantial heterogeneity (based on both observable and unobservable characteristics) in the impact of male migration.

Neoclassical micro theory sees the differentials in wages and employment opportunities between sending and host countries as major driving forces of migration. The inflow of migrants increases the supply of labor in receiving countries and could tighten labor supply in sending countries, thus lowering wage differentials. The withdrawal of women from market work because of male migration might accelerate this process of wage equalization. If particular types of jobs are held by women, the decrease in labor supply to those jobs could drive up the wages of people who still hold these jobs.

The policy implications of these results depend to a large extent on what women in migrant households are doing instead of working. If they are taking on farming tasks previously borne by their husband, that could imply a need to improve the wage labor market in rural areas to allow households to hire workers to replace those who migrate. Detailed information on time use is not available in the Nepal survey data and is rarely available elsewhere. Nepal and other countries should collect more information on both migration and time use to better understand the impact of male migration.

Migration is already high in Nepal and will likely continue to rise in response to the economic incentives offered by neighboring countries. The findings here highlight the gender dimension of the impact of predominantly male migration on the well-being of sending households. The effect of male migration on the work patterns of nonmigrating women has important implications for women's social status and could influence outcomes for other household members, particularly children. Thus, strategies for economic development in Nepal should take into account such gender aspects of migration dynamics.

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