Intergenerational Occupational Mobility in Rural Economy

Evidence from Nepal and Vietnam

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ABSTRACT

This paper presents evidence on intergenerational occupational mobility from agriculture to the nonfarm sector using survey data from Nepal and Vietnam. In the absence of credible instruments, the degree of selection on observables is used as a guide to the degree of selection on unobservables, à la Altonji et al. (2005) to address the unobserved genetic correlations. The results show that intergenerational occupational mobility is lower among women in both countries, and is lower in Nepal compared with Vietnam. In the case of Nepal, strong evidence favors a causal role played by the mother's nonfarm participation in the daughter's occupation choice, possibly because of cultural inheritance in a traditional society.

I. Introduction

The evolution of income distribution, inequality, and occupational structures across generations has attracted increasing attention in recent economic literature.[1] This renewed interest reflects a widely shared view that strong intergen-

1. See, for example, Arrow et al. (2000), Dearden et al. (1997), Mulligan (1999), Solon (1999, 2002), Birdsall and Graham (1999), Fields et al. (2005), Bowles et al. (2005), Blanden et al. (2005), WDR (2005), Mazumder (2005), Hertz (2005), Bjorklund et al. (2006).

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erational linkages in socioeconomic status may reflect inequality of opportunities and thus have profound implications for poverty, inequality, and (*im*) mobility in a society. A large body of econometric studies focusing mainly on developed countries finds that intergenerational correlations in earnings are positive and statistically significant, ranging from 0.14 to 0.50 (see Blanden et al. 2005; Solon 1999, 2002). A (relatively) small empirical literature in economics, again mostly in the context of developed countries, indicates significant positive correlations between parents and their children in occupational choices (see, for example, Lentz and Laband 1983; Dunn and Holtz-Eakin 2000 on the United States, and Sjogren 2000 on Sweden). Economic analysis of intergenerational mobility in developing countries, however, remains a relatively unexplored terrain,[2] even though the importance of such analysis has been duly recognized in the recent literature.[3] In this paper, we present evidence on the intergenerational occupational correlations in the nonfarm participation of two Asian developing countries, Nepal and Vietnam.[4]

Although there is a substantial literature on the determinants of nonfarm participation (see Lanjouw and Feder 2001 for a survey), the issue of intergenerational linkages has so far not received attention. Understanding occupational mobility in a rural economy is, however, important for poverty alleviation, as mobility from agriculture to nonfarm is often an avenue to escape from the poverty trap (World Development Report 2005; Lanjouw and Feder 2001). In the presence of strong intergenerational linkage in occupational choices, the standard cost-benefit analysis is likely to underestimate the long-run social returns to policy interventions that encourage nonfarm participation, as the intergenerational multiplier effect is ignored. Nonfarm participation often leads to "visible" income contribution by women and thus positively affects their bargaining power.[5]

A different but powerful argument derives from the role of nonfarm entrepreneurship in the long-run structural transformation of an economy. A dynamic nonfarm sector can be the seedbed for experimentation and development of an entrepreneurial class that eventually graduates to industrial activities, as was the case in Japan's rise to a modern industrial state from late Tokugawa to Meiji period (see Smith 1988).

2. This is exemplified by the fact that Solon (2002) refers to only two studies on developing countries in his survey of economic mobility (Lillard and Kilburn 1995 on Malaysia; Hertz 2001 on South Africa). Recent analyses of economic mobility in the context of developing countries include Lam and Schoeni (1993), Behrman et al. (2003), Fields et al. (2005), Dunn (2004). There is, however, a sociological literature that analyzes occupational mobility in both developed and developing countries (see Ganzeboom et al. 1991: Morgan 2005).

3. For example, Bardhan (2005) identifies intergenerational economic mobility as one of the important but underresearched areas in development economics.

4. Following the literature, we focus on the "occupation choice margin," that is, the choice between agriculture and nonfarm activities. As noted by an anonymous referee, in some cases the "participation margin" can be equally important for understanding economic mobility, especially when women's participation in economic activity is limited. In our data sets, most of the women are economically active–they work either in agriculture or nonfarm. Even in the mother's generation, nonparticipation is not very high. For example, in Nepal, 15 percent of mothers in the daughter's sample are nonparticipants. In the case of Vietnam, women's labor force participation is among the highest in the world.

5. Women's work in agriculture is usually unpaid and remains invisible in developing countries.

Our focus in this paper is on two issues: (i) intergenerational occupational persistence that is not driven by unobserved genetic correlations across generations, and (ii) gender effects in occupational mobility. The literature on the intergenerational economic mobility has been fraught with econometric challenges that arise from the unobservability of the genetic characteristics (ability and preference transmissions across generations), and the partial correlations observed in the data (from multivariate regressions) might be driven largely by such unobserved genetic correlations between parents and children.[6] The distinction between genetic transmissions and other sources of intergenerational linkages can be important from a policy perspective. If the observed intergenerational occupational correlation is primarily due to ability correlations, then the role public policy can play to influence economic mobility is relatively limited.[7] In contrast, when other tangible (for example, education and wealth) or intangible (for example, role model effects,[8] learning and reputation externalities, and social capital) environmental factors are important in intergenerational linkages, it provides arguments for policy interventions. Using household survey data, we present evidence that the degree of intergenerational occupational mobility in developing countries is both gender and country specific. Our results show that, in general, women face more restricted occupational mobility. The evidence also shows that occupational mobility varies across different countries; Vietnam shows higher mobility from agriculture to nonfarm activities compared with Nepal. The evidence indicates that, in the case of Nepal, the mother's nonfarm participation exerts a strong influence on the daughter's occupation choice, and this effect is not likely to be driven by genetic correlations. The evidence thus points more to a causal effect of the mother's occupational choice on the daughter's, possibly due to cultural inheritance in a traditional society. In contrast, there is weak or no evidence of a causal effect for Nepalese men, nor for either men or women in Vietnam.

In the absence of experimental data,[9] the standard approach to identification when facing unobserved heterogeneity is to look for credible instrumental variables (IVs). In the specific context of occupational mobility, the challenge for research design is to find exogenous variations that affect parental occupation choices but do not have any independent effect on children's occupation choices. However, most of the potential candidates for IV—such as family background variables that affect parent's occupation choices—tend to affect children's choices as well. Thus, it is difficult to

6. Genetic transmissions relevant for occupational choice include both ability and preference (especially the degree of risk aversion). However, the focus of the literature has been on ability correlations. In what follows, we couch the discussion primarily in terms of ability correlations, following the literature.

7. We, however, note that one should not take the distinction between genetic transmissions and other environmental factors too far. The evidence from behavioral genetics shows that there may be significant dynamic interactions between nature and nurture in determining human behavior (see, for example, Plomin et al. 2001).

8. The definition of role model adopted so far in economic literature is not uniform. While Durlauf (2000) defines role model as the influence of "characteristics of older members" on the "preferences of younger members," Manski (1993) and Streufert (2000) define it as observations on older members whose choices reveal information relevant for the choice of younger members. In this paper, we adopt a broad view that accommodates both of these definitions.

9. Designing and implementing a randomized experiment that can generate the data required for understanding the intergenerational occupational persistence can be challenging on both ethical and feasibility grounds.

defend the exclusion restrictions. Moreover, the common practice of using parental characteristics (such as parental education) as IVs is also suspect, as they are likely to be correlated with the unobserved common ability, and likely to violate the exogeneity criterion. A small literature in economics uses adoption as a quasiexperimental design to isolate the effects of environmental factors in intergenerational economic mobility (see, for example, Bjorklund et al. 2006; Plug 2004; Plug and Vijverberg 2003, Sacerdote 2002). A third strategy is to use twin samples to try to isolate the effects of nurture from nature (see, for example, Behrman and Rosenzweig 2002). However, studies using adoption or twin samples are confined mostly to the developed countries where reliable data are available. In the absence of quasi-experimental data on adoptions and twins or any credible identifying instruments, we exploit the econometric methodology recently developed by Altonji, Elder, and Taber (2005, 2000—henceforth AET 2005, 2000), which provides a way to gauge the importance of common (across generations) unobserved factors, such as ability in explaining an observed partial correlation, and thus helps to determine if at least part of the observed partial correlation is likely to be causal (due to environmental factors). We note that genetic transmissions (ability and preference) influence both parents' and children's nonfarm participation decisions and hence can be treated as unobserved (and correlated) determinants of occupational choices of both generations. This allows us to utilize a battery of recently developed econometric tests to ascertain whether the observed intergenerational occupational correlations can be attributed solely to the unobserved ability correlations between children and their parents.

The results from the econometric analysis are as follows. The univariate probit estimation for both Nepal and Vietnam indicates strong and positive intergenerational occupational correlations along gender lines (mother-daughter and father-son). In the case of Vietnam, there is also evidence of cross-gender linkages (father-daughter, mother-son). The correlations are robust to controlling for parental education, own age, and ethnicity (caste/tribe).[10] The estimated occupational linkages from univariate probit can, however, at least in principle, be entirely due to genetic transmissions across generations. The evidence from the econometric analysis using the AET (2005) methodology shows that this actually might be the case for the observed occupational correlations between father and sons both in Nepal and Vietnam; a low level of correlation in unobserved ability can explain away the estimated occupational linkages completely. In the case of Vietnam, the estimated partial correlation in nonfarm participation between mother and daughter is stronger than that between father and sons, but it also can be completely accounted for by moderate amount of selection on genetic endowments. In contrast, the intergenerational correlation between mother and daughter in Nepal is much stronger, and is highly unlikely to be driven by unobserved genetic correlations alone. The evidence suggests that at least part of the correlation between mother and daughter in Nepal is likely to be causal due to other factors such as "cultural inheritance" (Bjorklund, Jantti, and Solon 2007)

10. The conclusions reached in this paper are robust to the inclusion of indicators of human and physical capital of the child such as own education, land endowment, and demographic composition of the household. The results from this alternative specification are available from authors.

arising from role model effects, learning externalities, and transfer of reputation and social capital from parents to children, among other things.

The substantive conclusions above are extremely robust, confirmed by alternative econometric techniques as developed by AET (2005, 2000): (i) sensitivity analysis using a bivariate probit model, and (ii) estimates of lower bounds on intergenerational occupational correlations.[11] The lower-bound estimate in the case of Vietnam for both sons and daughters is negative implying that the univariate probit estimates (positive and statistically significant effect) can be fully accounted for by positive selection on unobserved ability and preference. For sons in Nepal, the results are similar; the lower bound is zero or negative. In contrast, for daughters in Nepal, the lower-bound estimate of occupational correlation with mother is about 0.70 with an implied marginal effect of 0.18 and *t*-value of 4.15. The 95 percent confidence interval for the marginal effect is [0.11 0.27], which does not include zero. The results for Nepalese women thus suggest that the genetic correlations account for about half of the partial correlation between the mother and a daughter, because the marginal effect in the univariate probit model is 0.35. The other half of the intergenerational correlation can be attributed to environmental factors such as cultural inheritance by a daughter from her mother in the form of role model effects, learning externalities, and transfer of reputation and social capital, among other things.[12] The results from the sensitivity analysis yield the same conclusions as above. Following AET (2005, 2000), we also estimate the bias in the partial correlation estimates from univariate probit. The estimates of the bias might be useful as robustness checks as they are not dependent on distributional assumptions. The bias estimates also lend strong support to the central conclusions discussed above.

The rest of the paper is organized as follows. Section II provides a conceptual framework that underpins the empirical work presented in the subsequent sections. Section III discusses the data and variables. Section IV, arranged in a number of subsections, presents the empirical results. We start with the stylized facts and then focus on gauging the role played by unobserved common determinants of occupational choice across generations following the approach due to AET (2005, 2000). In a subsection, we also discuss possible factors underlying the pattern of intergenerational linkages found in Nepal and Vietnam. Section V concludes the paper with a summary of the main findings.

II. The Conceptual Framework

In this section, we outline a simple model of participation in the nonfarm sector, highlighting different channels through which intergenerational link-

11. The empirical methodology proposed by AET (2005, 2000) can be used to provide a lower bound on intergenerational occupational correlation under the assumption that the "selection on observables" is at least as large as the "selection on unobservables." As we discuss in more detail later in the text, the assumption that the selection on observables dominates the selection on unobservables is a natural one in the context of intergenerational occupational mobility analyzed in this paper. The univariate probit model assumes "no selection on unobservables" and thus can be thought of as the upper-bound estimate of the intergenerational correlation.

12. Note that the environmental factors like role model effects and learning externalities from parents only affect the occupational choice of children and thus are not subsumed under the common intergenerational correlation.

ages may operate.[13] There are two sectors in the economy: agriculture (A) and the nonfarm sector (N). At the beginning of the working life, every person in the economy decides which sector to work for. Each individual is endowed with an innate ability $\theta_i \in [0,1]$ that captures attributes that are suitable for the nonfarm sector. A fundamental source of intergenerational linkage arises from the fact that the genetic endowments of a child (θ_i) are likely to be correlated with those of parents. The innate ability parameter θ_i is not known with certainty and every individual has to form an estimate utilizing all the available information.

In addition to ability, every individual is endowed with a vector of capital stock k_i comprised of human, financial, physical, and social capital. The higher is the level of k_i the higher is the probability of success in nonfarm activities. Parents can influence this initial capital stock k_i through their investment in a child's human capital (for example, financing of education, home tutoring by educated parents) and their transfer of financial and physical capital. The human capital accumulation of children is also likely to be influenced by the role model effects in education as they emulate parents' educational and occupational achievements. In addition, parental occupation can also influence their offsprings' human capital as children can gain valuable skills and experience by observing their parents at work, and by informal apprenticeship in parents' work place, especially when the nature of occupation is such that the workplace is in close proximity to home.[14]

At the beginning of the working life, individual i takes the endowment of capital and the estimate of ability (k_i,θ_i) as given, and optimally chooses the occupation $d_i \in \{A,N\}$. Let the information set available to individual i choosing occupation d_i be denoted as Ω_i, which includes k_i and θ_i. Let $F(Y_i|A;\Omega_i)$ denote the conditional distribution of income (Y_i) when individual chooses agriculture and the information set is Ω_i. The associated probability density function is denoted as $P(Y_i|A;\Omega_i)$. The preference of an individual i is represented by a concave utility function, $U_i(.)$, that reflects, among other things, the risk preference.[15]

We define the expected utility from choosing agriculture as:

$$V_i(A,\Omega_i) \equiv \int U_i(Y_i)P(Y_i \mid A;\Omega_i)dY_i$$

Analogously the expected utility from choosing the nonfarm sector is:

$$V_i(N,\Omega_i) \equiv \int U_i(Y_i)P(Y_i \mid N;\Omega_i)dY_i$$

13. The model utilized here can be viewed as an extension of the celebrated contributions of Becker and Tomes (1979 and 1986) and the extensions proposed in Sjogren (2000).
14. As noted by Lentz and Laband (1983), this proximity of work place to home is an important factor behind the observed strong intergenerational following in occupations like agriculture. This proximity is also important for household-based activities common in the microcredit programs in developing countries.
15. The preferences of a child are likely to be correlated with those of her parents. In addition, parents also can induce changes in children's preferences by acting as their role models (Durlauf 2000). The intergenerational correlation in preferences implies, for example, that, on an average, the children of the parents more inclined to taking risk will themselves be risk takers, and thus are more likely to become nonfarm entrepreneurs.

The individual chooses nonfarm employment iff the following holds:[16]

$$(1)\quad V_i(N,\Omega_i) - V_i(A,\Omega_i) \geq 0$$

The probability that an arbitrary individual i drawn from the population will decide to work in the nonfarm sector is $\Pr(V_i(N,\Omega_i) - V_i(A,\Omega_i) \geq 0)$. At the heart of the occupation selection process is the formation of expectation about payoffs from different options using the information set Ω_i. A critical element of the information set is the occupational choices of the parents as they reveal two types of relevant information: (i) information about one's own genetic endowment (or innate ability), (ii) information about the characteristics of a certain occupation. For example, if parents are successful (unsuccessful) nonfarm entrepreneurs, the estimate of children's ability to be successful in similar occupation will be revised upward (downward). The parental success in nonfarm may thus inspire the children to follow in their footstep due to "success bias" emphasized in the literature on cultural evolution (Boyd and Richerson 1985, 2005; Henrich and McElreath 2003). Another important channel is that revelation of information might reduce the uncertainty about the parental occupation. Thus, the information revealed by parental choices (and their outcomes) can influence children's occupation decision through their effects on the conditional distribution function of income Y_i giving rise to role model effects (Manski 1993; Streufert 2000).

The model presented above also can be used to explain intergenerational correlations running along gender lines. First, the genetic transmissions might have a gender dimension. Second, and probably the most important factor behind gender effects in intergenerational linkages is the gender dimension in cultural inheritance due to role model effects. Mother becomes the natural role model for a daughter, and the father for a son. Moreover, social norms regarding gender roles also might contribute to gender effects in occupation choice. As emphasized before, the strength of the role model effects is likely to differ across genders depending on the gender norms regarding the social and economic interactions.

For the econometric estimation, we can now employ a standard probit model taking inequality Equation 1 as the basis for our empirical specification. Specifically, we consider the binary response model (with slight abuse of notation):

$$(2)\quad N_i = 1\{N_i^* \equiv V_i(N,\Omega_i) - V_i(A,\Omega_i) \geq 0\},$$

For estimation we impose linearity and assume that the latent variable N_i^* is generated from a model of the form:

$$(3)\quad N_i^* = \alpha_p N_i^p + X_i'\gamma + \varepsilon_i$$

Where $X_i \subseteqq \Omega_i$ is a vector of explanatory variables and ε_i is the idiosyncratic random disturbance term. In the econometric analysis, the vector of explanatory variables X_i exogeneous controls for heterogeneity across individuals in terms of preferences (U_i), and productivity (ability) information contained in Ω_i. Equation 2 forms the basis

16. Assuming that the tie is broken in favor of nonfarm sector.

of much of our empirical analysis. A complete list of explanatory variables X_i is provided in appendix Tables A1a and A1b.

III. Data

The data sets used in this paper are from the World Bank Living Standards Measurement Study (LSMS). The data access policies are described at the LSMS web site.[17]

The data for Nepal come from the Nepal Living Standard Survey (NLSS) 1995/96. The NLSS consists of a nationally representative sample of 274 primary sampling unit (PSUs) selected with probability proportionate to population size, covering 73 of the 75 districts in Nepal. In each of the PSUs, 12 households were also selected randomly (16 households in the Mountain regions) providing a total sample size of 3,373 households. From these households, about 6,670 individuals aged 20–60 participated in the labor force. This is our main sample for empirical analysis.[18] For these individuals, information from the survey can be used to identify the parents. Note that each respondent was asked about his/her parents, but the parents were not interviewed separately if the parents were not coresidents in the household. The labor force participation status of some fathers was not reported, reducing the sample to 6,544. Splitting the sample into male and female gives us a sample of 3,242 males and 3,302 females. To avoid perfect fit due to lack of within-village employment variations, regressions automatically drops 1,378 observations in the female sample and 479 observations in the male sample. In addition, about 286 mothers in the daughters sample and 619 mothers in the sons sample did not report labor force participation status. The results presented in the paper are based on the samples that exclude these observations.

The data for Vietnam are drawn from the Vietnam Living Standard Survey (VLSS) 1992/93.The survey randomly selected 150 communes (30 in urban areas and 120 in rural areas), with probability proportionate to their population sizes.[19] From each commune, two clusters were drawn randomly, with probability proportional to their population size. The survey then randomly selected 16 households from each cluster. The VLSS thus consists of a nationally representative sample of 4,800 households from all areas of Vietnam. The sample design was self-weighted, which means that each household had the same probability of being selected. Our main sample consists of 8,592 individuals in the age group 20 to 60 years who participated in the labor force. The parental questionnaire in VLSS was nearly identical to that of NLSS 1995/96. This helps us to make the empirical analysis comparable across Nepal and Vietnam.

17. A researcher needs permission from the respective governments (that is, Vietnam and Nepal) to use the data.
18. An earlier version of this paper was based on a sample of 8,394 individuals in the age group 14 to 70 years. The conclusions from this alternative sample are very similar to the ones reported here.
19. There were about 10,000 communes in Vietnam at the time of VLSS 1993.

The labor force participation status of about 12 percent of the fathers and 11 percent of the mothers was not reported in VLSS, reducing the sample to 6,764. Splitting the sample into male and female gives us a sample of 3,051males and 3,713 females. When villages with no employment variation are dropped from the sample, we have a final sample of 2,602 for males and 2,698 for females.

The main samples for both Nepal and Vietnam exclude observations when mother's employment status is not reported. For example, in the case of Nepal, 14.9 percent of mothers in daughters sample and 22.4 percent of mothers in the sons sample did not report the labor force participation status and these observations are excluded from the sample. As part of robustness checks, we conduct the empirical analysis without dropping these observations while introducing a dummy to indicate lack of information on mother's employment status. The results are similar to the ones from the main samples, and are presented later in Subsection VB.

The NLSS and VLSS contain detail information on employment by sectors and by occupations at individual levels. The surveys are special in the sense that they contain an entire section of questionnaire on parental information, including level of education, sector of employment, and place of birth. From the occupation information, we define our dependent variable as a binary variable taking the value of one if an individual is employed in nonfarm activities and zero otherwise.[20] Similarly, we define separate indicator variables for mother and father showing their employment in the nonfarm sector.[21]

IV. Empirical Results

A. Stylized Facts

We begin the empirical analysis by focusing on the basic patterns of intergenerational correlations in the data. As mentioned before, we are not aware of any analysis of intergenerational mobility out of agriculture to the nonfarm sector in developing countries in the economics literature. Thus, the pattern of correlations and partial correlations from simple probit models may be of independent interest.

Table 1 reports the basic statistics on employment status of daughters and sons in Nepal and Vietnam. The (unconditional) probability of being employed in the nonfarm sector in Nepal is estimated to be 47 percent for a man and 17 percent for a woman. The corresponding numbers for Vietnam are 31 percent for a man and 29 percent for a woman. It is interesting that even the basic correlations in data make it clear that the patterns of intergenerational occupational correlations in Nepal and Vietnam are markedly different; the gender gap is much smaller in the case of Vietnam. The difference in gender gap is confirmed by a formal test of differences in means; the gender gap is statistically significant (at 1 percent) and numerically large in Nepal, but small and statistically insignificant in Vietnam. A comparison of

20. Nonfarm is defined as nonagricultural, that is, excludes SIC one digit code "0." Nonfarm thus includes industries and services.

21. Note that similar to NLSS, in VLSS also the parents were not interviewed separately when they are not coresidents in the household.

Table 1
Nonfarm participation of children conditional on Parent's Employment Status (weighted mean): Nepal and Vietnam

	Probability of being Employed in Nonfarm Activities			
	Nepal		Vietnam	
	Daughters	Sons	Daughters	Sons
Mother's employment				
Farm	0.144	0.458	0.228	0.262
Nonfarm	0.591	0.653	0.694	0.638
Difference	0.447***	0.195***	0.436***	0.374***
Father's employment				
Farm	0.151	0.433	0.237	0.25
Nonfarm	0.268	0.652	0.525	0.582
Difference	0.117***	0.219***	0.288***	0.332***
Unconditional	0.168	0.47	0.291	0.306
Difference between daughters and sons		−0.3***		−0.02
N	1,578	2,204	2,698	2,602
Correlations in nonfarm participation rates of				
Husband-wife	0.337		0.348	
Father-mother	0.47		0.498	

* significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent
Source: Nepal Living Standard Survey (NLSS) 1995/96 and Vietnam Living Standard Survey (VLSS) 1992/93

sons' and daughter's employment status conditional on father's and mother's employment status reveals that, in both the countries, the probability of being employed in the nonfarm sector is much higher for children if their father or mother were employed in nonfarm as well. We also test the significance of difference between probabilities of being employed in the nonfarm sector by parent's employment status (farm vs. nonfarm). The test results reported in Table 1 indicate that in all cases the null hypothesis of no difference can be rejected at the 1 percent level. Table 1 also reports the occupational correlations between father-mother and husband-wife; it is interesting that the correlations in nonfarm participation of spouses become weaker in the children's generation, which probably indicates specialization according to comparative advantage within the household, among other things.

With a clear indication of positive intergenerational correlations between parents' and children's occupational choices in Table 1 above, we turn to a more formal econometric analysis. Starting from a simple probit regression of son's and daughter's occupations on parental occupations, we take a sequential approach, introducing appropriate control variables in subsequent steps. The uppermost panel in Table 2 reports the regression results for daughters and the middle panel for sons. The results in the lowest panel use the full sample to test the importance of a child's gender in the intergenerational occupational persistence.[22]

Columns 1 in the uppermost panel of Table 2 reports the coefficients of N^f (father in nonfarm) and N^m (mother in nonfarm) in the regression for son's and daughter's participation in the nonfarm sector without any additional controls. The results from the probit regression show that mother's nonfarm participation has a significant positive influence on daughter's probability of participation in the same sector in both Nepal and Vietnam. The marginal effect of mother's participation in the nonfarm sector (N^m) is estimated to be 0.45 (Nepal) and 0.40 (Vietnam). These are large effects compared with the daughter's average probability of participation in nonagriculture of 0.17 (Nepal) and 0.29 (Vietnam). In contrast, father's participation in the nonfarm sector in Nepal appears to have no statistically significant effect on daughter's likelihood of being employed in the same sector, and a much smaller effect (marginal effect 0.12) in Vietnam. The results for sons reported in the middle panel of Table 2 (Columns 1) indicate a significant positive correlation between father and son's employment in the nonfarm sector. The marginal effect of father's employment in the nonfarm sector (N^f) is around 0.20 in Nepal and 0.23 in Vietnam (both are significant at 1 percent level). Compared with father, mother's nonfarm participation (N^m) has a numerically and statistically insignificant effect in Nepal. Interestingly, the mother's effect on sons in Vietnam is strong and similar to that of father in terms of numerical magnitude.

The next set of results reported in Columns 2, Table 2 includes a number control variables including parental education (both mother and father), age of an individual, dummies for ethnicity and/or tribe, and religion. The education levels of father and mother are used as indicators of human capital in the household when a child was growing up. Following a large literature in labor economics, we include the age of an individual as a human capital variable representing the work experience.[23] The access to nonfarm jobs may also depend on the personal networks. The social and economic networks often run along ethnic group/caste.[24] This is likely to be especially important in Nepal where the force of the caste system is strong, but may not matter much in Vietnam, as most of the sample in Vietnam consists of the ethnic Vietnamese population. We thus include a set of dummies depicting the ethnicity (caste and tribe) of an individual in Nepal. To represent the social network in Vietnam, we use religion as an indicator. The ethnic or religious identity may also capture differences in access to capital. We include an individual's marital status to account for taste and/or lifecycle related heterogeneity. The summary statistics for these explanatory variables are presented in Appendix Table A1.

The results reported in Columns 2, Table 2 show that the addition of controls does not affect the estimated intergenerational partial correlations in any significant way either in Nepal or Vietnam (see the top and middle panels). Although the

22. We thank Rajeev Dehejia for suggesting this approach.
23. In addition, age and its squared term capture any cohort effect.
24. Ethnicity also may capture access to credit.

Table 2
Probit Estimates of Intergenerational Correlations Marginal Effects from probit estimation (evaluated at sample mean)

	Nepal			Vietnam		
	(1)	(2)	(3)	(1)	(2)	(3)
	Daughter's sample			Daughter's sample		
Father in nonfarm (n^f)	−0.006	−0.003	0.004	0.120	0.127	0.067
	(0.20)	(0.09)	(0.15)	(4.56)***	(4.64)***	(2.35)**
Mother in nonfarm (n^m)	0.454	0.429	0.342	0.402	0.384	0.221
	(7.10)***	(6.40)***	(5.52)***	(12.76)***	(11.88)***	(6.22)***
Pseudo-R^2	0.10	0.50	0.62	0.17	0.20	0.46
Test of equality of father and mother's coefficients						
X^2	24.60	21.61	13.26	29.47	22.81	7.29
P-value	0.00	0.00	0.00	0.00	0.00	0.00

	Son's Sample			Son's Sample		
Father in nonfarm (nf)	0.208	0.169	0.173	0.231	0.213	0.137
	(5.39)***	(4.02)**	(3.91)***	(8.08)**	(7.30)**	(4.48)**
Mother in nonfarm (nm)	0.059	0.034	0.089	0.247	0.260	0.138
	(0.95)	(0.54)	(1.30)	(7.29)**	(7.43)**	(3.72)**
Pseudo-R^{2}[a]	0.04	0.28	0.46	0.13	0.17	0.44
Test of equality of father and mother's coefficients						
X^2	3.11	2.31	0.78	0.06	0.62	0.00
P-value	0.08	0.12	0.38	0.81	0.43	0.99
	Full sample			Full Sample		
Mother in nonfarm (n^m)*Daughter	0.429	0.469	0.484	0.399	0.400	0.286
	(5.96)***	(6.29)***	(6.15)**	(12.61)***	(12.27)***	(8.06)**
Father in nonfarm (n^f)*Son	0.311	0.164	0.163	0.245	0.227	0.158
	(8.39)***	(4.15)***	(4.14)**	(8.69)***	(7.79)***	(5.21)***
Individual and household characteristics[b]	No	Yes	Yes	No	Yes	Yes
Village fixed effect	No	No	Yes	No	No	Yes

Note. Standard errors are corrected for intra-cluster correlations due to clustered sampling.
[a] Pseudo R^2 is defined as $\mathrm{Var}(X'\gamma)/[1+\mathrm{Var}(X'\gamma)]$
[b] Regressors in Column 2 include age, age squared, dummy for married, unearned income, 3 ethnicity dummies, father and mother's education level and share of nonfarm employment by age cohort. Regressors in Column 3, in addition to above regressors, include village-level fixed effect.
* significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent

regressions in Columns 2 include a number of controls, the intergenerational correlation in occupation may still be spurious because both parents and children may have similar labor market opportunities specific to a geographic location. For instance, if both parents and children live in an area with better nonfarm opportunities (say a textile mill), then intergenerational correlation in nonfarm participation may be an artifact of not adequately controlling for nonfarm opportunities in the regression. To control for unobserved location-specific heterogeneity in nonfarm opportunities, we included village-level fixed effects in the estimation. The village fixed effects may also capture other village-specific determinants of occupational choice like peer effects and agglomeration forces. In addition, we define the share of nonfarm employment in total employment of an individual's age cohort in her district of birth as an additional control for labor market opportunity and possible peer effects. This may capture the time-varying part of labor market opportunities in a village.

The results from regressions with village fixed effect as well as the measure of intertemporal labor market opportunity are reported in Columns 3 of Table 2 (top and middle panels). These village-level controls lead to an increase in the explanatory power of the regressions substantially. The Pseudo R^2s of the probit models are 0.62 (Nepal) and 0.46 (Vietnam) in daughter's sample, and 0.46 (Nepal) and 0.44 (Vietnam) in son's sample. Despite the inclusion of such powerful controls, the qualitative results regarding intergenerational occupational correlations discussed above remain largely unchanged. Although the marginal effects of parental occupation on children's occupation choice (mother-daughter and father-son) decline in all of the cases, it is still large. The cross-linkage between father and daughters found in the regressions in Columns 1 and 2 in the case of Vietnam becomes smaller. The strength of the cross-linkage between mother and son in Vietnam, however, remains strong and is comparable in magnitude to the partial correlation between father and son.

We also formally test the difference between the effects of mother and father on a given child (both daughter and son). The results from the test of the null that the father's and mother's influences are equal to each other are presented at the bottom of the top and middle panels of Table 2. Not surprisingly, the evidence rejects the null unambiguously for daughters, but for sons the null cannot be rejected in either Nepal or Vietnam when we control for village fixed effects.

The full regression results corresponding to Columns 3 in the top and middle panels of Table 2 are reported in the appendix (see Table A2). The village fixed effects (not reported) in both Nepal and Vietnam are significant at the 1 percent level, indicating that village-specific factors such as local labor market conditions and infrastructure play important roles in mobility out of agriculture.

The results reported in the last panel of Table 2 formally tests whether a child's gender matters for intergenerational occupational linkages. We use the pooled sample of sons and daughters and report the marginal effects of mother-daughter interactions in the daughter's case, and father-son's interaction in the son's occupation choice regression. The estimated marginal effects show clearly that interaction effects are positive, numerically large, and statistically significant. This provides evidence for strong gender effects in intergenerational occupational linkages.

B. Unobserved Common Factors: Can They Plausibly Explain the Partial Correlations?

The results discussed so far show that the intergenerational occupational correlations between parents and children in Nepal run along gender lines (father-son and mother-daughter), but in Vietnam both parents seem to exert significant effects on a child's occupation choice. The evidence indicates that the estimated partial correlations from multivariate probit models are not solely due to "tangible" determinants of occupational choice such as parental education, age, and ethnicity as they are already controlled for in the regressions in Table 2. The results cannot be driven by village-level factors such as labor market opportunities, peer effects, and geographic agglomeration as we include village fixed effect. However, as discussed before, an important question from the policy perspective is how much of the partial correlations uncovered in Columns 3 of Table 2 are causal due to environmental factors as opposed to genetic correlations in occupational choices.

In the absence of credible identifying instruments, we utilize a number of ways to ascertain whether the observed intergenerational correlations can be explained solely in terms of unobserved ability correlations (and other unobserved common determinants). The methods employed include (i) sensitivity analysis à la Rosenbaum and Rubin (1983), Rosenbaum (1995) and AET (2005, 2000); (ii) estimation of lower bounds that cannot be due to factors common to both generations, such as genetic endowment. As an additional robustness check, we also report estimates of the omitted-variables bias in the probit regression using the techniques developed by AET (2005, 2000).

1. Sensitivity Analysis

The regression results presented in the previous section demonstrate that the inclusion of a powerful set of controls does not lead to a substantial weakening of intergenerational occupational correlations along gender lines (mother-daughter and father-son) in both Nepal and Vietnam. The cross-linkages also seem to be important in the case of Vietnam.[25] Although suggestive, this evidence cannot be taken as convincing in favor of intergenerational linkages not driven by genetic correlations. We now explore whether a small amount of selection on unobservables can explain away the estimated partial correlations in intergenerational occupational choices in Columns 3, Table 2.

Consider the following bivariate probit model for individual i.

$$(4) \quad N_i = 1(\alpha_p N_i^p + X_i'\gamma_1 + \delta_j\omega_j + \xi > 0),$$

$$(5) \quad N_i^p = 1(X_i'\beta_1 + \delta_j\omega_j + u > 0)$$

25. In an earlier version of the paper, we reported estimates that use additional controls in Column 3, Table 2 such as individual and spousal education, inherited land, migrant in the household, among others. When these additional controls are included, the cross-linkages found in the case of Vietnam become very weak. We chose to exclude these variables from Specification 3, Table 2, as they are, at least in part, outcomes of parental occupation choices and thus inappropriate as controls.

$$(6)\quad \begin{bmatrix} u \\ \xi \end{bmatrix} \sim N\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix}$$

where N_i (also N_i^p) is a binary occupation choice variable which takes the value 1 for nonfarm and zero otherwise, ω_j is the village dummy (fixed effect) included to control for unobserved and observed community-level determinants, including labor market opportunities and peer effects. We use an index of village fixed effects derived from univariate probit estimates as the bivariate probit model does not converge if we use village dummies. We estimate the magnitudes of intergenerational correlations for different values of the correlation (ρ) between the unobserved determinants of nonfarm participation of parents (u) and children (ξ).[26] The vector of explanatory variables (X) is the same as that in the regression results presented in Columns 3, Table 2. The results are reported in Table 3. Following AET (2005), the sensitivity analysis is performed for $\rho = 0.1, 0.2, 0.3, 0.4, 0.5$. Note that the correlation coefficient ρ represents only that part of genetic correlation across generations that influences the occupational choice and thus is likely to be much smaller than the average genetic correlation between parents and children. The sensitivity analysis based on the bivariate probit model works especially well when there are no cross-gender effects (father-daughter and mother-son), as we have to deal with two endogeneous variables. The evidence in Table 2 above shows no significant cross-effects in the case of Nepal, but the cross-effects may be important for both sons and daughters in the case of Vietnam.[27] In the presence of cross-gender effects, one can implement the sensitivity analysis in two alternative ways: (i) estimate the model ignoring the effects of the "other" parent's occupation, (ii) condition on the "other" parent's occupation.[28] If the other parent's occupation is excluded, it becomes part of the error term and can be subsumed under the common genetic influences. As it turns out, the estimates and the conclusions of the paper do not depend on whether we condition on the other parent's occupation when estimating a particular intergenerational link in the case of Vietnam. The results for Vietnam reported in Table 3 do not condition on the other parent's occupation. The results from the specification with conditioning are available from the authors.

In Table 3 we first note that with a low level of selection on genetic endowments ($\rho = 0.10$), the results in Columns 3, Table 2 hold up reasonably well, although the numerical magnitudes of the intergenerational linkages become smaller. However, when we allow for moderate level of correlation on unobservables (genetic or otherwise) ($\rho = 0.20$), the strong cross-effect between fathers and daughters in Vietnam reported in Column 3, Table 2 does not survive, and the occupational link between mothers and sons in Vietnam becomes numerically small. The results from univariate

26. As discussed in AET (2005, 2000) the bivariate probit model above is identified because of nonlinearity. However, such identification based on functional form alone in the absence of valid instruments is treated with skepticism in applied literature (termed "weak identification"). In what follows, the bivariate probit model is treated as underidentified and thus the sensitivity analysis is performed across alternative values of ρ.

27. As noted before, if we add additional household and individual level controls, the cross-effects in the case Vietnam become small and insignificant. This indicates that they might not be robust. The results from sensitivity analysis support this view.

28. We thank Todd Elder for clarifications on this point.

Table 3
Estimates of Intergenerational Correlations for different values of correlation of disturbances in bivariate probit models

Correlation of disturbances	Nepal: Daughter's Sample Mother in Nonfarm (n^m)	Nepal: Son's Sample Father in Nonfarm (n^f)	Vietnam: Daughter's Sample Mother in Nonfarm (n^m)	Vietnam: Son's Sample Father in Nonfarm (n^f)	Vietnam: Daughter's Sample Father in Nonfarm (n^f)	Vietnam: Son's Sample Mother in Nonfarm (n^m)
ρ = 0	0.348	0.193	0.256	0.19	0.153	0.212
	(6.80)***	(5.01)***	(8.34)**	(6.89)***	(5.97)***	(6.45)***
ρ = 0.1	0.27	0.123	0.186	0.124	0.091	0.141
	(5.60)***	(3.19)***	(6.25)***	(4.64)***	(3.67)***	(4.41)***
ρ = 0.2	0.196	0.051	0.117	0.059	0.032	0.071
	(4.40)***	(1.35)	(4.13)***	(2.30)**	(1.34)	(2.35)**
ρ = 0.3	0.129	−0.021	0.052	−0.002	−0.024	0.006
	(3.18)***	(0.57)	(1.92)*	(0.08)	(1.06)	(0.21)
ρ = 0.4	0.069	−0.093	−0.01	−0.059	−0.076	−0.055
	(1.92)*	(2.59)***	(0.41)	(2.60)**	(3.59)***	(2.06)**
ρ = 0.5	0.018	−0.162	−0.067	−0.112	−0.124	−0.109
	(0.56)	(4.79)***	(2.95)***	(5.33)***	(6.33)***	(4.53)***
N	1,578	2,204	2,698	2,602	2,98	2,602

Note: Entries are marginal effect evaluated at sample mean. Standard errors are corrected for intracluster correlations due to clustered sampling. *t*-values are in parentheses.
[a] Regressors include age, age squared, dummy for married, unearned income, three ethnicity dummies, father and mother's education level, share of nonfarm employment by age cohort, and an index of village fixed effect.
[b] Regressors include age, age squared, dummy for married, unearned income, two religion dummies, father and mother's education level, share of nonfarm employment by age cohort, and an index of village fixed effect.
* Significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent

probit (Table 2) that assume $\rho = 0$ thus can be misleading in the presence of moderate genetic correlations across generations. The evidence for intergenerational persistence between mothers and daughters both in Vietnam and Nepal is, however, stronger. The estimated effects remain statistically significant at 1 percent level when $\rho = 0.20$ and they are also not small numerically. When the unobserved correlation across generations reaches $\rho = 0.30$, all the intergenerational effects except mother-daughter links fail to survive. Even in the mother-daughter link (with $\rho = 0.30$), the evidence is not as strong in the case of Vietnam, the estimated intergenerational occupation effect is numerically small, less than half of that in Nepal. The evidence of intergenerational persistence is thus very strong for the mother-daughter link in Nepal. Although the estimated marginal effect declines monotonically with an increase in ρ, it is still positive in Nepal when ρ is as high as 0.50. The marginal effects are statistically significant at 1 percent level up to $\rho = 0.30$ and at 10 percent level when $\rho = 0.40$; it becomes statistically insignificant only when ρ is as high as 0.50. These results suggest that the unobserved genetic correlations pertinent to occupation choice would have to be implausibly high to explain away the entire effect of N^m (mother in nonfarm) on a daughter's nonfarm participation in Nepal.

2. Lower Bounds on the Intergenerational Occupational Persistence

The sensitivity analysis above indicates that the value of ρ would have to be large to completely explain away the effect of mother's nonfarm employment on that of daughters in both countries, especially in Nepal. This can be interpreted as strong evidence in favor of a causal role of mother's nonfarm participation in a daughter's occupation choices. But the literature offers no estimate of ρ to use as a benchmark. The available evidence from Behavioral Genetics shows that both the genetic transmissions and environmental factors are important in the correlation between the parents and children, especially for complex traits and behavior.[29] The problems in pinning down a plausible range for ρ are more daunting in our case, as other explanatory variables such as parents' education and ethnicity (that is, caste and tribe) are likely to pick up a substantial part of this correlation.[30] In the absence of any plausible way of judging the magnitude of the genetic correlations relevant for occupation choices in a rural economy as captured by ρ, we utilize an approach suggested by AET (2005). This allows us to estimate both the magnitude of ρ and bounds for the intergenerational correlations.

To illustrate the basic insights behind AET (2005) approach, we consider Equation 3 (with village fixed effects added). It defines the latent variable N_i^* that determines children's participation in the nonfarm sector as:

$$N_i^* = \alpha_p N_i^p + X_i' \gamma_1 + \delta_j \omega_j + \varepsilon \tag{7}$$

29. For example, the correlation between IQ scores of parents and children is around 0.5 (Plomin et al. 2001; Griffiths et al. 1999). This estimate, however, includes both the effects of nature (heritability) and nurture (familial context).

30. This implies that the value of ρ relevant for our analysis should be smaller than otherwise.

where N_i^p is the dummy variable for nonfarm participation by parents and ω_j is the village fixed effect for village j where individual i lives in. Let N^{p*} is the latent variable such that $N^p = 1$ if $N^{p*} > 0$ and zero otherwise. We can define the linear projection of N^{p*} on $X'\gamma,\omega$ and ε as (for notational simplicity, the subscript is dropped) :

(8) $\quad \text{Proj}(N^{p*} | X'\gamma_1,\omega,\varepsilon) = \varphi_0 + \varphi_{X'\gamma_1} X'\gamma_1 + \omega'\delta + \varphi_\varepsilon \varepsilon$

Following AET (2005), we can interpret $\varphi_{X'\gamma_1}$ as the "selection on observables" and φ_ε the "selection on unobservable." However, unlike AET (2005), we use a village-level fixed effect to sweep off the observed and unobserved village-level determinants. This implies that the selection on observables ($\varphi_{X'\gamma_1}$) and unobservables (φ_ε) both represent only the individual characteristics. An advantage of this formulation is that it fits well with the notion that the "unobservables" are like "observables." An alternative approach is to include the village fixed effects as part of the observables. The argument is that the location of an individual is an observable characteristic.[31] The linear projection ofN_p^* in this case becomes:

(9) $\quad \text{Proj}(N^{p*} | Z'\gamma_2,\varepsilon) = \varphi_0 + \varphi_{Z'\gamma_2} Z'\gamma_2 + \varphi_\varepsilon \varepsilon;\ Z = (X,\omega)$ and $\gamma_2 = (\gamma_1,\delta)$

The advantage of this formulation is that it is more likely to satisfy the condition that selection on observables is dominant, which helps in deriving the lower bound on intergenerational occupational linkage (see below).[32] We perform the analysis under these alternative interpretations (Equations 8 and 9).[33] Note that in the case of univariate probit regressions, the maintained assumption is that there is no selection on unobservable, that is, $\varphi_\varepsilon = 0$. AET (2005, 2000) and Altonji, Conley, Elder, and Taber (2005) (henceforth ACET 2005) show that selection on observables can be used as a guide to selection on unobservables. They point out that in many applied economic applications, it is a natural assumption that the selection on observables dominates the selection on unobservables, which leads to the following conditions in our case (analogous to Condition 3 in AET 2005):

(10) $\quad \varphi_{X'\gamma_1} \geq \varphi_\varepsilon \geq 0$

(11) $\quad \varphi_{Z'\gamma_2} \geq \varphi_\varepsilon \geq 0$

Following AET (2005), we can implement the econometric estimation under the above restriction(s) and treat the estimate of α_p (Equation 7) corresponding to the case of equality of selection on observables and unobservables (that is, for example, $\varphi_{X'\gamma_1} = \varphi_\varepsilon$) as the lower bound on the part of intergenerational occupational linkage that is not driven by genetic transmissions. The inequality Conditions 10 and 11

31. We thank Chris Taber for pointing out the alternative interpretations of the fixed effects.
32. Since location choice is endogeneous, the village fixed effects will capture some of the unobserved individual characteristics that are common to the villagers.
33. A third alternative is to exclude the fixed effects altogether and use village-level observed controls (share of nonfarm). The conclusions of this paper remain unchanged in this formulation, although the lower-bound estimates are larger than reported here.

above are eminently plausible in our case due to the following considerations.[34] First, as pointed out earlier, the addition of a set of powerful determinants of occupation choice affects the strength of intergenerational linkages, especially between mother and daughter in Nepal, only marginally, although the Pseudo R^2 goes up dramatically (see Columns 2 and 3 in Table 2). Focusing on the interesting case of the Nepal mother-daughter linkage, the Pseudo R^2 increases from 0.10 to 0.50 when we include determinants of occupational choice (Column 2, Table 2). The estimated partial correlation in nonfarm participation by mother and daughter is, however, barely affected (it declines from 0.45 to 0.43). The results for the mother-daughter link in Vietnam are also similar. This indicates that (i) the observables explain a large part of the variations in nonfarm participation, and thus leave room for only a limited role for the unobserved individual characteristics; (ii) the estimated partial correlation is likely to be robust to possibly include additional controls (if such data were available). Second, data for our analysis come from a multipurpose household survey that was conducted primarily for poverty assessment. The role of nonfarm occupations as an avenue to escape poverty traps in a low-income agrarian economy is much discussed (Lanjouw and Feder 2001). Thus, it is only natural that the survey includes rich information on the determinants of nonfarm participation identified in the recent literature. This means that these observable characteristics are likely to pick up a substantial part of the unobserved genetic correlations relevant for occupation choice, a point mentioned earlier, but worth emphasizing again here. This also means that the selection on unobservable genetic endowment captured in φ_ε will be much smaller in our analysis. Third, we can decompose the error term in the occupation choice by children as in Equation 4: $\xi = \xi_1 + \xi_2$, where ξ_1 is the part of selection on unobservables that is common to both generations but is determined at the time of parental occupation choice, and ξ_2 represents the unobserved shocks that occur during the children's occupation choice. As shown by AET (2005), this implies that selection on observables is greater providing additional justifications for inequality Conditions 10 and 11 above.

In the case of bivariate probit (Equations 4–6), the lower-bound estimate of α_p can be estimated by imposing the following conditions depending on the treatment of fixed effect:

$$(12) \quad \rho = \left(\frac{\mathrm{Cov}(z'\beta_2, z'\gamma_2)}{\mathrm{Var}(z'\gamma_2)}\right);\ \beta_2 = (\beta_1, \delta)$$

$$(13) \quad \rho = \left(\frac{\mathrm{Cov}(x'\beta_1, x'\gamma_1)}{\mathrm{Var}(x'\gamma_2)}\right)$$

Table 4 reports the estimates of the lower bounds on the intergenerational partial correlation (that is, lower-bound estimates of α_m and α_f) that is not due to common unobserved factors across generations.[35] The central conclusions of this paper are

34. We are grateful to Chris Taber and Todd Elder for clarifying the relevance of the Conditions 10 and 11 in our analysis.

35. To ensure robustness of our findings, we also check whether these results are driven by the joint normality assumption underlying the bivariate probit model. Following AET (2005), we utilize semiparametric specification for the error terms. The results are very close to the estimates reported in Table 4 and thus are not reported for the sake of brevity.

Table 4
Estimates of Lower Bounds for the Intergenerational Correlations Bivariate Probit Estimation

		Daughter's Sample		Son's Sample	
		ρ	α_m	ρ	α_f
Nepal[a]					
	$\rho = \mathrm{Cov}(Z\gamma_2, Z\beta_2)/\mathrm{Var}(Z\gamma_2)$	0.221	0.182	0.226	0.033
		(1.89)*	(4.15)***	(4.15)***	(0.86)
	$\rho = \mathrm{Cov}(X\gamma_1, X\beta_1)/\mathrm{Var}(X\gamma_1)$	0.226	0.178	0.313	−0.031
		(2.03)*	(4.08)***	(4.85)***	(0.83)
Vietnam[b]					
	$\rho = \mathrm{Cov}(Z\gamma_2, Z\beta_2)/\mathrm{Var}(Z\gamma_2)$	0.665	−0.148	0.53	−0.129
		(1.17)	(7.91)***	(1.68)*	(6.29)**
	$\rho = \mathrm{Cov}(X\gamma_1, X\beta_1)/\mathrm{Var}(X\gamma_1)$	0.51	−0.069	0.432	−0.077
		(1.39)	(3.08)***	(1.61)	(3.45)***

Note: Entries are marginal effect evaluated at sample mean. Standard errors are corrected for intra-cluster correlations due to clustered sampling. *t*-values are in parentheses.
[a] Regressors include age, age squared, dummy for married, unearned income, three ethnicity dummies, father and mother's education level, share of nonfarm employment by age cohort, and an index of village fixed effect.
[b] Regressors include age, age squared, dummy for married, unearned income, two religion dummies, father and mother's education level, share of nonfarm employment by age cohort, and an index of village fixed effect.
* significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent

not sensitive to the treatment of fixed effects and we focus our discussion on the case defined by Equation 12, where the fixed effects are included as part of the vector of observables.[36] The estimated magnitudes of correlations between unobserved determinants of parent's and children's nonfarm participation are similar for daughters and sons in both Nepal and Vietnam.[37] Focusing on the central case from the sensitivity analysis earlier, the intergenerational correlation between mother's and daughter's nonfarm participation in Nepal is statistically significant at 1 percent level (t-value = 4.15). The estimated lower bound on the causal effects of mother's nonfarm participation on daughter's choice of nonfarm in Nepal is positive and large in

36. To avoid noncovergence in the biprobit model, we use a slightly different set of observables to estimate the lower bound in Vietnam when the fixed effects are not included as part of the observables.
37. As pointed out by an anonymous referee, the fact that the magnitude of ρ is similar for sons and daughters implies that the lower-bound estimates will reflect the strength of the partial correlations in the probit regressions in Column 3 of Table 2. Since the magnitude of implied bias is same for daughters and sons samples and the partial correlation is much higher for daughters in Nepal, the selection on unobservables cannot wipe off the effect in the daughter's sample.

magnitude with a marginal effect of 0.18. In contrast, for sons in Nepal, the estimated lower bound for a causal effect of father's nonfarm participation is very small and statistically insignificant ($\alpha_f = 0.033$ with a t-value of 0.86). The results in Panel 1, Table 4 thus strengthen our central conclusion from the sensitivity analysis in Section IVB1 above—that the estimated partial correlation in the nonfarm participation of mother and daughter in Nepal is not likely to be driven entirely by the genetic correlations; at least part of the occupational linkage seems causal, reflecting environmental factors such as cultural inheritance through role-model effects, learning externalities, and transfer of reputation and social capital from mother to the daughter as discussed in the conceptual framework above. In contrast, the lower-bound estimate for the correlation in father's and son's nonfarm participation in Nepal is close to zero and not significant. This implies that the observed (positive) intergenerational correlation may be an artifact of genetic transmissions across generations.

Interestingly, the lower-bound estimates in the case of Vietnam are negative for both sons and daughters (see Panel 2 in Table 4) implying that the evidence of intergenerational persistence is weak. The negative estimate for daughters implies that even the apparently strong link between mothers and daughter in Vietnam can be fully accounted for by selection on unobservables. Also, the fact that the lower-bound estimates for sons and daughters are similar in magnitudes can be interpreted as evidence of lower gender gap in Vietnam. The evidence thus indicates that intergenerational mobility is higher in Vietnam and the gender gap is lower compared with Nepal.

C. Additional Robustness Checks

1. The Amount of Selection on Unobservables Required to Eliminate the Effect of a Parent on Children's Occupation

In this section, we provide additional evidence on the strength of intergenerational occupational linkages from an alternative approach that uses selection on observables to estimate the extent of bias caused by selection on unobservables. Following AET (2005), we use the following condition on the normalized difference in the index of observables and that in the mean of the unobservables across the "treatment status" (that is, nonfarm occupation as the treatment):

$$(14) \quad \left(\frac{E(\varepsilon \mid N^p = 1) - E(\varepsilon \mid N^p = 0)}{\mathrm{Var}(\varepsilon)}\right) = \left(\frac{E(X'\gamma_1 \mid N^p = 1) - E(X'\gamma_1 \mid N^p = 0)}{\mathrm{Var}(X'\gamma_1)}\right)$$

Using the above restriction and assuming that the bias in probit model is well approximated by the bias in the linear probability model, AET (2005) derive the following formula for the bias:

$$(15) \quad Bias = \left(\frac{\mathrm{Cov}(\tilde{u},\varepsilon)}{\mathrm{Var}(\tilde{u})}\right) = \left(\frac{\mathrm{Var}(N^p)}{\mathrm{Var}(\tilde{u})}\right)\left[\left(\frac{(E(X'\gamma_1 \mid N^p = 1) - E(X'\gamma_1 \mid N^p = 0)\mathrm{Var}(\varepsilon))}{\mathrm{Var}(X'\gamma_1)}\right)\right]$$

where index $X'\gamma$ can be estimated using a simple probit regression of Y on X under the null hypothesis that $\alpha_p = 0$. In probit estimation, $\mathrm{Var}(\varepsilon) = 1$. The residual u can be estimated by running an OLS regression of N^p on X. The advantage of this bias

Table 5
Omitted Variable Bias and intergenerational correlations

	Daughter's sample		
	α_m	Bias	Ratio
Nepal[a]	0.348 (6.80)***	0.14	2.55
Vietnam[b]	0.256 (8.34)***	0.50	0.51
	Son's Sample		
	α_f	Bias	Ratio
Nepal[a]	0.193 (5.01)***	0.14	1.42
Vietnam[b]	0.19 (6.89)***	0.34	0.554

Note: Entries are marginal effect evaluated at sample mean. Standard errors are corrected for intracluster correlations due to clustered sampling. *t*-values are in parentheses.
[a] a. Regressors include age, age squared, dummy for married, unearned income, three ethnicity dummies, father and mother's education level, share of nonfarm employment by age cohort, and an index of village fixed effect.
[b] Regressors include age, age squared, dummy for married, unearned income, two religion dummies, father and mother's education level, share of nonfarm employment by age cohort, and an index of village fixed effect.
* significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent

estimate is that it does not involve estimation of a bivariate probit model and thus does not depend on joint normality assumptions.

The estimation results are reported in Table 5. The estimated bias in the mother-daughter occupational linkage is 0.14 in Nepal and 0.50 in Vietnam. With a coefficient estimate of 0.35 in Nepal, the bias estimate implies that the normalized shift in the distribution of unobservables has to be 2.55 times higher than that in the index of observables to completely erase the estimated causal effect of mother's occupations, which is highly unlikely. In contrast, the normalized shift in unobservables needs to be only one-half of that in observables to completely eliminate the correlation between mother and daughter in Vietnam.

In the sons samples, the bias estimate is much higher in the case of Vietnam and the evidence supports the earlier conclusion that there is no evidence of a causal role of father's nonfarm participation in son's participation in the same sector. In the case of Nepal, the bias estimate for the father-son occupational link is somewhat

Table 6
Robustness check: Full Sample Includes Mothers Who Did Not Participate in Labor Force

	Daughter's Sample			Son's Sample		
	N	ρ	α_m	N	ρ	α_f
Nepal						
Upper bound	1,877	0.000	0.315	2,858	0.000	0.177
			(6.62)***			(5.38)***
Lower bound	1,877	0.143	0.208	2,858	0.29	−0.030
		(1.49)	(4.86)**		(6.96)***	(0.95)
Vietnam						
Upper bound	2,944	0.000	0.231	2,980	0.000	0.193
			(7.56)***			(7.81)***
Lower bound	2,944	0.516	−0.094	2,980	0.57	−0.147
		(0.61)	(4.26)***		(1.91)*	(7.93)***

Note: Entries are marginal effect evaluated at sample mean. Standard errors are corrected for intracluster correlations due to clustered sampling. *t*-values are in parentheses.
* significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent

smaller (0.14), but given the low estimate of the coefficient (0.19), there is little evidence in favor a causal effect of father's nonfarm participation on son's choice of nonfarm occupation.

2. Bounds Estimates from an Alternative Sample

The empirical results presented so far are based on a sample that excludes the observations when the mother did not report her labor force participation status. In this section, we report results based on the larger sample that includes those observations. We include a dummy that equals one when mother did not report labor force participation status. For the sake of brevity, we report only the lower-bound estimates, but the results from other approaches including sensitivity analysis and bias estimates are similar. Table 6 presents the results for two alternative assumptions regarding selection on observables: (i) selection on unobservables is zero (univariate probit case) and (ii) selection on unobservables is equal to selection on observables. Following AET (2005), we interpret these estimates as upper and lower bounds, respectively.

The results are consistent with the estimates discussed earlier; according to the lower-bound estimates, there is strong evidence of a large effect of mother's nonfarm participation on daughter's participation in the same sector in Nepal. The lower-bound estimates in the other three cases are negative, implying that the observed positive correlation in the univariate probit estimates may be driven by selection on unobservables.

D. Discussion: The Pattern of Intergenerational Occupational Linkages

The empirical analysis of intergenerational occupational mobility out of agriculture presented above shows important differences between Nepal and Vietnam and also between men and women in a given country. The evidence clearly shows that women face much more restricted occupational mobility and this effect is significantly stronger in Nepal. The lower-bound estimates indicate that occupational mobility is, in general, higher in Vietnam. What are the possible sources of such differences? A proper analysis of this question is beyond the scope of this paper, and constitutes an important topic of future research. With this in mind, we provide some preliminary discussion here.

1. Nepal Vs. Vietnam

The difference between Nepal and Vietnam may be due, among other things, to differences in educational attainment, economic growth, and social norms regarding women. The gap in educational attainment of children between Vietnam and Nepal is striking, and probably one of the most important factors that drive the observed differences in occupational mobility. In our data sets, the average level of education among daughters in Vietnam is more than four times as high as in Nepal (1.47 years of schooling in Nepal and 6.97 in Vietnam). Similarly, for sons, the average education in Vietnam is almost two times as high (4.02 years in Nepal and 7.97 in Vietnam).

Although Vietnam has experienced impressive economic growth after the implementation of economic reform in 1986 (Doi Moi), Nepalese economy has been characterized by low growth. In the survey year, GDP growth rate was 8 percent in Vietnam (1993) and 3 percent in Nepal (1995). The reform in agricultural incentives and relaxation of rice export quota in Vietnam increased productivity through intensive use of fertilizer and pesticides (the agricultural sector grew at 5.1 percent rate over 1988–95 period compared to 2.8 percent over 1960–87 period, Goletti et al. 1997). The strong income growth in both rural and urban areas is likely to create higher demand for nonfarm products. In contrast, in Nepal agriculture has been stagnant (growth rate in agricultural value-added was zero in 1995) and as a result structural change has been slow.

2. Gender, occupational Mobility and Cultural Inheritance

An important finding from our empirical analysis is that there is a significant gender gap in occupational mobility in Nepal. The evidence clearly indicates that part of the estimated intergenerational correlation between mother and daughter in Nepal is likely due to factors such as cultural inheritance through role model effects, learning, and reputation externalities as discussed earlier in the conceptual framework.

In a traditional patriarchal society like Nepal, we expect the cultural inheritance to be stronger for daughters because of gender norms. The mother plays a dominant role in a daughter's life due to a combination of the gender effects discussed in the conceptual framework. The women in Nepal face both explicit and implicit discriminations in almost all spheres of social and economic interactions (Bennett 2005; Asian Development Bank 1999). The inheritance customs and practices are explicitly against women's ownership of productive resources like land.[38]

There is a clear gender division of work; women's economic activities are concentrated in and around the household, while men participate more in the formal labor market (Acharya and Bennett 1983). There is a striking gender bias in favor boys in parental investment in human capital. For example, in 1996, the literacy rate for male was 57 percent and only 27 percent for female (Asian Development Bank 1999). The fact that the girls are less likely to go to school or more likely to drop out early implies that their domain of interactions remains limited.

In contrast to Nepal, gender discrimination in Vietnam is lower and social customs do not restrict women's social and geographic mobility in any significant way. In terms of gender equality in education, healthcare, and employment, Vietnam ranks favorably compared with similar or even higher income countries in East Asia (Asian Development Bank 2002). Labor force participation of women in Vietnam is among the highest in the world and there is little gender gap. Even though there is likely to be some gender preference (son preference is common) in Vietnam, the social and economic conditions in Vietnam are much more favorable for gender equality and this may explain the smaller gender gap in the intergenerational occupational mobility in Vietnam.

V. Conclusions

The economic literature on intergenerational mobility has witnessed a renewed interest in recent years. However, most of the existing economic research focuses on the income correlations between father and son(s) in the context of developed countries. The intergenerational economic mobility in developing countries remains largely unexplored. Using data from two Asian developing countries, Nepal and Vietnam, we present evidence on the intergenerational occupational mobility from agriculture to the nonfarm sector with an emphasis on possible gender differences. Because it is extremely difficult, if not impossible, to find credible instrument(s) to address the genetic correlations (ability and preference), we employ the recent econometric approach developed by Altonji, Elder, and Taber (2005, 2000) to ascertain if the estimated partial correlations in nonfarm participation can be attributed solely to genetic transmissions or at least part of the effect is likely to be causal due to environmental factors such as role model effects (more broadly cultural inheritance). The approach uses the degree of selection on observables as a guide to the degree of selection on unobservables. It allows us to estimate lower bounds of the intergenerational occupational correlations that are not due to common genetic

38. Although the 1990 constitution enshrines equal rights irrespective of gender, the family laws that govern property rights, inheritance, marriage, and divorce reinforce the patriarchy and put severe constraints on women's command over resources. For example, the national Code of Nepal (Mulki Ain) of 1963 that codifies the inheritance system derives from the Hindu custom of patrilineal descent and a patrifocal residence system.

correlations across generations. The results show that intergenerational occupational persistence, especially for daughters, is much stronger in Nepal. The intergenerational occupational correlation between mother and daughter is stronger in Vietnam compared to the correlation between father and son (see partial correlations in Table 2 and the sensitivity analysis in Table 3). But as the lower-bound estimates in Table 4 show even the relatively stronger link between mother and daughter in Vietnam can be driven entirely by common unobserved heterogeneity such as genetic transmissions. The observed partial correlation between the father and a son in both Nepal and Vietnam from multivariate regression can be explained away by low to moderate correlations in genetic endowments across generations.[39]

The occupational persistence between mother and daughter(s) is relatively stronger, and it is especially strong in the case of Nepal. The evidence from a battery of econometric tests for selection on unobservables shows that it is highly unlikely that the estimated partial correlation between mother and daughter in Nepal is driven solely by the unobserved genetic correlations. The evidence points to a causal effect of the mother's occupation choice on that of the daughter beyond the widely discussed channels such as human capital, assets, and ethnicity. The estimated lower bound on the mother-daughter intergenerational occupational correlation in Nepal shows a marginal effect of 0.18. The evidence from Nepal reported and discussed in this paper indicate that a lack of economic growth when combined with discriminatory social norms against women can make it extremely difficult for women to move out of traditional economic activities like agriculture. The evidence from Vietnam, on the other hand, supports the converse proposition that a dynamic economy in conjunction with more gender-neutral social norms can dramatically improve women's occupational mobility.

39. The fact that the occupational correlation between father and son is weak for both Nepal and Vietnam can be interpreted as an indication of importance of social norm in occupational mobility. As discussed above, economic growth experience diverged significantly across these two countries. It is interesting that even with low economic growth, sons in Nepal enjoy high occupational mobility.

Table A1
Summary Statistics, Nepal, 1995/96 and Vietnam, 1992/93

	Nepal			
	Daughters (N = 1,578)		Sons (N = 2,204)	
	Mean	Standard Deviation	Mean	Standard Deviation
Participation in nonfarm employment (proportion)	0.168	0.374	0.450	0.498
Father's level of education (years)	0.959	2.514	0.868	2.399
Mother's level of education (years)	0.095	0.813	0.040	0.483
Age	34.707	11.039	36.682	11.796
Age squared	1,326.300	844.400	1,484.600	919.400
Married	0.906	0.291	0.889	0.314
Unearned income (million Rs)	0.008	0.052	0.005	0.056
Upper caste Hindu (Proportion)	0.362	0.481	0.326	0.469
Lower caste Hindu (Proportion)	0.070	0.255	0.077	0.266
Tribal (Proportion)	0.270	0.444	0.284	0.451
Share of nonfarm in district by age cohort	0.135	0.138	0.309	0.145
	Vietnam			
	Daughters (N = 2,698)		Sons (2,602)	
	Mean	Standard Deviation	Mean	Standard Deviation
Participation in nonfarm employment (proportion)	0.291	0.454	0.306	0.461
Father's level of education (years)	4.537	4.761	4.390	4.658
Mother's level of education (years)	2.248	3.678	2.095	3.540
Age	35.350	10.420	35.680	10.770
Age squared	1,358.000	797.000	1,389.000	839.000
Married	0.807	0.395	0.851	0.356
Unearned income (thousand dong)	1,062.400	3,939.400	1,074.800	4,278.600
Religion (Buddhists = 1)	0.232	0.422	0.25	0.433
Religion (Other = 1)	0.092	0.289	0.087	0.282
Share of nonfarm in district by age cohort	0.17	.198	0.19	0.202

Data Source: Nepal Living Standard Survey (NLSS) 1995/96 and Vietnam Living Standard Survey (VLSS) 1992/93

Table A2
Probit Estimation of Intergenerational Correlations, Nepal and Vietnam

	Nepal		Vietnam	
	Employment Status			
	Daughters in Nonfarm Sector	Sons in Nonfarm Sector	Daughters in Nonfarm Sector	Sons in Nonfarm Sector
Mother in nonfarm (n^m)	0.342	0.089	0.221	0.138
	(5.52)***	(1.30)	(6.22)***	(3.72)**
Father in nonfarm (n^f)	0.004	0.173	0.067	0.137
	(0.15)	(3.91)***	(2.35)**	(4.48)**
Age (years)	0.011	0.035	0.024	0.029
	(1.79)*	(3.70)***	(3.30)***	(3.29)**
Age Squared	−0.000	−0.000	−0.000	−0.000
	(1.50)	(3.66)***	(3.43)***	(4.03)**
Married	−0.030	0.105	−0.082	−0.077
	(0.97)	(2.43)**	(3.27)***	(2.02)*
Unearned income (million	−2.258	0.169	0.000	0.000
Rs)	(3.06)***	(0.90)	(2.55)**	(2.19)*
Upper caste Hindu	−0.022	−0.158		
(Proportion)	(0.81)	(3.19)***		
Lower caste Hindu	0.010	0.073		
(Proportion)	(0.25)	(1.01)		
Tribal (Proportion)	0.053	−0.227		
	(1.62)	(4.09)***		
Religion (Buddhists = 1)			−0.019	−0.069
			(0.61)	(2.17)*
Religion (Other = 1)			0.084	0.002
			(1.98)**	(0.05)
Father's level of education	0.003	0.002	−0.001	0.002
(years)	(0.84)	(0.34)	(0.52)	(0.82)
Mother's level of education	0.012	0.052	−0.002	−0.001
(years)	(1.43)	(1.99)**	(0.79)	(0.33)
Share of nonfarm in district	1.152	1.753	0.122	−0.165
by age cohort	(5.51)***	(7.65)***	(1.62)	(1.96)*
Observations	1,578	2,204	2,698	2,602

Note: Entries are marginal effect evaluated at sample mean. Standard errors are corrected for intracluster correlations due to clustered sampling. *t*-values are in parentheses.
All regressions include a set of village-level dummies. * significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent

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