Migration and Imperfect Monitoring: Implications for Intra-household Allocation

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Studies of the impact of migration on sending households (*e.g.* Dean Yang, 2004; Alejandra Edwards and Manuelita Ureta, 2003) have largely neglected the fact that certain allocations can only be imperfectly monitored when household members are not co-resident (see Ralph Chami, Connel Fullenkamp and Samir Jahjah, 2003 for an exception). In this case, allocations can only be coordinated to the extent that they can be monitored, and household decision-making may not be fully cooperative. The existence of such behavior among household members would suggest that expanding opportunities for migration will have different effects on expenditure patterns than simply increasing the amount of income received by the household. Changes in earned income and the potential to earn income will affect bargaining among spouses, but non-cooperative behavior will have an additional effect on the final distribution of expenditures and allocations.

With the rising trends in both rural-urban and international migration, it is essential to understand this dynamic of household decision-making in order to assess the ultimate impact on sending families, child welfare and gender disparities. Non-cooperative behavior would also have important implications for policy and program design because it implies that the channel through which income is received can have important spillover effects, even beyond any direct effect on income or bargaining power. Direct subsidies are easily observed by other household members; in contrast, micro-credit loans and the proceeds of micro-credit enterprises could be concealed from one's spouse and used to finance expenditures that otherwise would not be undertaken.

I. Non-Cooperative Decision-Making

Household bargaining can be thought of as a repeated game in which individuals may be either cooperative or non-cooperative. Shelly Lundberg and Robert Pollak (1993) suggest that households may revert to a non-cooperative outcome when transaction costs associated with cooperation are high. However, non-cooperation will not affect provision of household public goods or equilibrium utilities, provided that both individuals make strictly positive contributions to household production. In the case of migration, the non-resident household member cannot contribute to household production. Furthermore, migration introduces imperfect monitoring of actions in the sending household, thereby increasing the cost of enforcing cooperative arrangements.

To describe how non-cooperative behavior may arise, consider a simple example in which there are two decision-makers, a husband and a wife, and two public goods, x and y. These goods must be supplied by the wife when the husband is absent, and husbands and wives have different preferences for x and y. Suppose that x is easily observable (*e.g.* cleanliness of the household, height/weight of children), whereas y is very difficult to monitor when the husband is away from home (*e.g.* individual leisure, individual nutritional intake). When migration occurs, the household can still reach a cooperative agreement on x because the cost of enforcing this agreement is low. In contrast, the determination of y is more likely default to a non-cooperative process because this good is costly to monitor. Thus, if the wife chooses to behave non-cooperatively, we should observe changes (*i.e.* deviations from the cooperative equilibrium) in goods that she prefers, but only if those goods are difficult to monitor. Furthermore, the magnitude of the deviations should be responsive to the efficacy of monitoring.

II. Data and Specification

Identification of non-cooperative behavior thus requires data on allocations with varying degrees of transparency. The China Health and Nutrition Survey is ideal for such an analysis because it includes data on easily observable outcomes such as height and weight as well as information on less observable inputs such as individual nutritional intake and time allocation. The sample includes roughly 4,000 households, approximately 15,000 individuals, drawn from nine diverse provinces. Households were first surveyed in 1989, with follow-ups in 1991, 1993, 1997 and 2000. The timing of the survey is well-suited for the study of migration, as the 1990s were a period of rapid growth in intra-national labor migration. This was, in large part, due to a relaxation of migration restrictions in 1988, which allowed individuals to obtain legal temporary residence in other localities. Increased openness and marketization in the 1990s also spurred economic growth, which increased the demand for construction and service workers in urban areas (Alan de Brauw and John Giles, 2005).

The panel nature of the data allows for inclusion of individual fixed effects to account for the endogeneity of migration, and community-year fixed effects are included to control for time-varying factors that may affect the migration decision. Migrants are defined as individuals living away from the household for at least one full month in the previous year. The sample of migrant-sending households is further limited to those in which the father was away from the household for all seven days in the week prior to enumeration, because most outcomes of interest are defined over the previous week. Selected descriptive statistics are presented in Table 1, with observations at the household-year level. Differences in observable characteristics between migrant and non-migrant households are relatively minor. Migrant-sending households hold less value in productive assets, but appear to be positively selected on schooling.

I estimate reduced-form demand equations for child health and nutrition and household labor of both children and mothers. Data on the quantity of time spent in various household activities was collected inconsistently across surveys, so identification must rely on changes in household labor on the extensive rather than intensive margin. For individual *i* in household *j* in community *k* at time *t*, the demand for good *g* can be expressed as

$$g_{ijkt} = \alpha + \beta \cdot h_{jkt} + \phi \cdot z_{ijkt} + \delta \cdot away_{jkt} + \rho \cdot (months\ away_{jkt}) + \gamma \cdot (c_{ijkt} \cdot away_{jkt}) + \upsilon_{ijk} + \eta_{kt} + \pi_t + \varepsilon_{ijkt}$$

where *h* is a vector of time-varying household characteristics, *z* is a vector of individual covariates, and *c* is a subset of those covariates which are allowed to vary with father's migration status. The error term consists of four components – an individual effect that is fixed over time (υ), a time effect that is specific to the community of residence but fixed across individuals within an area (η), a survey-year fixed effect (π), and a mean-zero i.i.d. disturbance (ε).

Controls for the father and mother's current wages are included to account for changes in household income over time. For individuals engaged in occupations that do not pay by time or piece rate, predominantly agricultural work, the wage is imputed as the prevailing daily wage for an unskilled farm laborer. Additional control variables include a quadratic in age, parents' ages (for child-level regressions), assets owned (farm land, farming equipment, value of small business capital and area of owned home), household size, number of children (number of siblings for child-level regressions), sex composition of children (siblings), as well as month of survey. Parents' schooling attainment changes very little over time and is therefore subsumed into the fixed effect. Age is allowed to vary with father's migrant status because it is correlated with productivity, and more productive children are more likely to be pulled into household labor when fathers are absent. The number of months the father is away is also included in all specifications as a rough proxy for the overall level of transparency in intra-household

allocations. That is, the efficacy of monitoring varies with the frequency and spontaneity of return visits, and reduced monitoring allows for larger deviations from the cooperative allocations.

III. Empirical Implications and Findings

The appropriate counterfactual for identifying non-cooperative behavior is the set of allocations that would be chosen by the household, conditional on the migration decision, if both spouses could costlessly commit to cooperation. In the absence of non-cooperative behavior, the effect of migration on intra-household allocation consists of three components. First, there is a reduction in fathers' household labor, which is equivalent to a compensated increase in fathers' wages. This is a standard substitution effect which increases both fathers' market labor and mothers' household labor, given general assumptions on the utility function and imperfect substitutability of market goods in household production. The effect on child labor is ambiguous because an increase in child labor increases household production but also provides direct disutility to parents. Second there is an increase in household income, which will decrease child labor and increase mothers' household labor, provided that public goods are normal. Lastly, migration by one spouse may induce a shift in bargaining power within the household. This will shift household labor towards the lower-weighted spouse, but the effect on child labor depends on the individuals' relative preferences for household production and child leisure.

A cooperative model of the household thus predicts that migration should increase mothers' household labor hours, unless mothers have more bargaining power when fathers are away. In contrast, a non-cooperative model of household decision-making suggests that, because individual time allocation is difficult to monitor, mothers will decrease own household labor when fathers migrate. Estimates in Table 2 suggest that, in fact, mothers are reducing time in

household labor. It is possible that this simply reflects increased demand for mothers' labor in household enterprises to compensate for the father's absence. However, the second column in Table 2 indicates that this is not the case; mothers are reducing labor supply in income-generating activities as well as in household activities. Mothers appear to be consuming more leisure when fathers migrate.

If the overall level of household production is fairly easy to observe, however, a non-cooperative model also suggests that mothers will increase children's household labor in order to compensate for the reduction in their own labor hours. Table 3 presents estimates of the effect of migration on children's household labor. The probability that daughters do laundry or prepare food for the household is increasing in the number of months the father is away, and the opposite is true for sons. Point estimates are statistically significant only for laundry but quite large in magnitude – average marginal effects indicate that the probability that sons do laundry is 6.1 percentage points lower and the probability that daughters do laundry is 19.1 percentage points higher, compared to the baseline in which approximately 7.3% of boys and 18.7% of girls aged 6-16 do laundry. If this result were driven simply by an increase in the demand for child household labor to compensate for the father's absence, a similar pattern should also have been evident for mothers.

However, the data are consistent with a case in which migration increases mothers' bargaining power but household decision-making remains cooperative. An increase in mother's bargaining power would also predict increases in other goods favored by the mother, whereas a non-cooperative model would predict changes in goods preferred by the mother only if those goods are difficult to monitor. To distinguish the two models, I examine the effect of migration on an easily observable outcome - child health. Esther Duflo (1999) and Duncan Thomas (1990)

have shown that an exogenous increase in women's income has larger effects on child health than a similar increase in male income. Estimates in the first column of Table 4 reveal that migration has no significant on children's BMI, suggesting that mothers' bargaining power has not increased. There are, however, large changes in children's caloric intake. This is because labor hours and nutrition are both inputs to the health production function. Child health is easily observed and thus unlikely to be affected by non-cooperative behavior. But, if mothers wish to adjust the allocation of household labor, nutrition must be simultaneously adjusted to maintain health.

IV. Conclusions

The type of non-cooperative behavior observed in this setting appears relatively innocuous; changes in household labor are compensated by changes in nutritional intake in order to maintain child health. However, increasing opportunities for international migration, *i.e.* migration over longer distances and for longer periods of time, will exacerbate information asymmetries. The ultimate effect on intra-household allocation will depend on the capacity for monitoring and the preferences of decision-makers remaining in the sending household. To the extent that this information problem constrains the allocation of remittance income to easily observable goods, non-cooperative behavior may generate inefficiencies in investments and hinder growth. Development agencies may also wish to consider how the efficacy of targeted transfers and subsidies is affected by the transparency of those income sources.

Further research should consider the effect of non-cooperative behavior on a broader range of allocations which have larger implications for economic growth, *e.g.* schooling-related expenditures and investments in income-generating activities. To do so, it will be critical to understand how remittance flows are affected by non-cooperative behavior on the part of both

recipients and senders. If migrants' earnings are difficult for sending households to monitor, migrants face a trade-off when determining the value of remittance flows. An increase in remittances will increase the migrant's bargaining power in the household but, because the migrant must then bargain with other household members over the allocation of this income, remittance flows will effectively be taxed, even when there is no non-cooperative behavior on the part of recipients.

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Table 1. Selected Characteristics of Households by Migrant Status

	Father Never Migrates	Father Currently Away
Mother's Schooling	5.636	6.195 **
	(4.129)	(3.744)
Father's Schooling	7.539	7.899 *
	(3.497)	(3.034)
Area of Owned Home	66.31	65.12
	(54.86)	(50.82)
Farm Land	3.636	3.121
	(8.807)	(6.662)
Value of Business Equip.	213.1	58.77 ***
	(2234)	(388.4)
Months Away in the Year		6.606
		(3.878)
Observations	5666	264

Notes: Standard deviations reported in parentheses. (*) indicates significantly different from first column at the 10%, (**) 5% or (***) 1% level. Observations at the household-year level.

Table 2. Mothers' Time Allocation, Mother Fixed Effects Estimates

	Do Any Chores	Work Hours (ex. chores)
Father Away	0.077 *	12.19
	(1.66)	(1.52)
Months Father Away	-0.031	-5.581 *
	(1.63)	(1.81)
Months Away Squared	0.002	0.459 *
	(1.48)	(1.90)
Marginal Effect of Away	**-0.041**	**-4.397**
	(1.36)	**(1.03)**
Sample Mean	0.974	43.50
Observations	6450	5996

Notes: t-statistics in parentheses, based on robust standard errors. Marginal effects calculated at values approximate to the sample average. Includes controls for own and husband's age, own and husband's wages, assets owned, household size and composition, month and year of survey, and community-year fixed effects. (*) indicates significant at the 10%, 5% (**) or 1% (***) level.

Table 3. Children's Time Allocation, Child Fixed Effects Estimates

	Prepare Food	Do Laundry
Dad Away	0.253	0.228
	(1.51)	(1.17)
Months Away	-0.047	-0.084 *
	(0.97)	(1.65)
(Months Away)^2	0.003	0.007 *
	(0.82)	(1.79)
(Age-6)*Away	-0.044	0.013
	(1.15)	(0.31)
(Age-6)^2*Away	0.004	-0.001
	(0.95)	(0.35)
Marginal Effect of Away	**-0.064**	**-0.061**
	(0.74)	**(0.07)**
Relative Effects for Girls		
Dad Away	-0.116	-0.365
	(0.56)	(1.27)
Months Away	0.065	0.164 **
	(1.01)	(2.11)
(Months Away)^2	-0.003	-0.013 **
	(0.63)	(2.19)
(Age-6)*Away	0.006	-0.015
	(0.11)	(0.21)
(Age-6)^2*Away	0.000	0.002
	(0.07)	(0.25)
Marginal Effect of Away	**0.120**	**0.191**
	(1.07)	**(1.56)**
Sample Mean - Boys	0.057	0.073
Sample Mean - Girls	0.117	0.187
Observations	8476	8329

Notes: t-statistics in parentheses, based on robust standard errors. Marginal effects calculated at values approximate to the sample average. Includes controls for sibling composition, also interacted with migrant status, age of parents, assets owned, household size and composition, month and year of survey, and community-year fixed effects. (*) indicates significant at the 10%, 5% (**) or 1% (***) level.

Table 4. Children's Health and Nutrition, Child Fixed Effects Estimates

	Body Mass Index	Daily Calorie Intake
Dad Away	-0.671	288.0
	(0.80)	(1.04)
Months Away	0.203	10.96
	(0.80)	(0.12)
(Months Away)^2	-0.025	-3.574
	(1.13)	(0.43)
(Age-6)*Away	0.155	-181.0 **
	(0.60)	(2.05)
(Age-6)^2*Away	-0.015	18.11 **
	(0.61)	(1.98)
Marginal Effect of Away	0.351	-139.7
	(0.96)	(0.98)
Relative Effects for Girls		
Dad Away	0.657	-409.8
	(0.38)	(0.92)
Months Away	-0.18	53.31
	(0.40)	(0.38)
(Months Away)^2	0.02	-2.433
	(0.52)	(0.22)
(Age-6)*Away	-0.539	211.4 *
	(1.03)	(1.76)
(Age-6)^2*Away	0.063	-24.68 **
	(1.21)	(1.99)
Marginal Effect of Away	-0.898	160.5
	(1.05)	(0.70)
Sample Mean - Boys	17.14	1851
Sample Mean - Girls	17.11	1711
Observations	6121	7303

Notes: t-statistics in parentheses, based on robust standard errors. Marginal effects calculated at values approximate to the sample average. Includes controls for sibling composition, also interacted with migrant status, age of parents, assets owned, household size and composition, month and year of survey, and community-year fixed effects. (*) indicates significant at the 10%, 5% (**) or 1% (***) level.

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