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Abstract

In recent years analysts have examined the effects of bargaining power over household economic decisions on individual well-being. Much of this work has focused on the determinants and consequences of women's bargaining power. We build on this line of research by classifying households into three types of power structure based on whether the mother, the father, or both jointly decide on food purchases and preparation, and by estimating the association of each household power type on children's nutritional status in a highly autarkic society of foragers and horticulturalists, the Tsimane' of the Bolivian Amazon. Biases from self-perceived measures of parental bargaining power are overcome in two ways. First, we match the responses of the two parents to questions about who makes decisions related to food purchases and preparation. Second, we use parental attributes characterizing own well-being as instrumental variables for bargaining power. Using data from a survey done in 2004, we regress the body-mass index (BMI; kg/m^2) of 569 children

under 13 years of age belonging to 221 households on the following explanatory variables: household power structure type, child's characteristics (age, sex, schooling, illness), mothers' and fathers' characteristics (schooling, assets, stature), the value of total household food consumption, and community characteristics. Separate regressions were run for each of the three types of households. We find that (1) shared power between mothers and fathers is associated with 3.9% (p=0.02) higher child BMI, (2) mother's bargaining power is associated with 3.0% (p=0.01) lower BMI, and (3) the BMI of sons and daughters do not differ in households where parents share power. We consider why shared power may result in better nutritional status for children independent of the sex of the child. The evidence presented here suggests that development projects that aim to shift household resources to strengthen the bargaining power of only one parent might have inadvertent consequences for child well-being.

I. Introduction

Empirical work has refuted the idea that parents agree on how to allocate labor and other resources to improve household well-being (Alderman, Chiappori, Haddad, Hoddinott & Kanbur 1995; Schultz 1990; Vermeulan 2002). Contemporary household models characterize household utility by totaling each parent's utility function, which is shaped by their own preferences (Vermeulan 2002). Consequently, preferences have a large impact on the well-being of children. Resources invested in a child are determined not only by the level of resources available, but also by a parent's preferences. Preferences between parents need not be the same; therefore outcomes of mothers' and fathers' actions can differ (Chiappori 1988; Manser & Brown 1980). To exercise preferences, a parent must have the ability to do so. Economists have proposed game-theoretic models to explain decision making and intra-

household resource distribution in light of parental preferences (Agarwal 1997; Chiappori 1988; Manser & Brown 1980). The work suggests that bargaining power over household economic decisions, especially when held by women, is associated with improved well-being for herself and her children than when the same resources are in the hands of men (Haddad & Hoddinott 1994; Rubalcava, Teruel & Thomas 2004; Thomas 1994). To advance empirical understanding of who holds power in the household, a classification and examination of different types of power structures, and their consequences, must be undertaken.

In this paper we ask a simple but important question: What type of power structure in the household produces the best impact on child well-being? We use body-mass index (BMI; kg/m^2), an anthropometric indicator of short-run nutritional status among children, as a proxy for child well-being. In nuclear households, one can envision at least three types of power structures. In one, the male head of the household, or father, exercises most decisions. In the second, the female head of the household head, or mother, exercises most of the decisions. In the third, the father and the mother share the power equally through joint decision making. The study presented here takes a unique and rare approach by analyzing all three power structures in parallel. Additionally, studies typically simply evaluate an individual outcome, commonly women's or mothers' well-being, as a result of acquiring greater power over household economic decisions; in this analysis we investigate children's well-being (Hindin 2000). We ensure an objective measure of a person's power that is not defined merely by the individual's self-perception. We use instrumental variables to correct for the endogeneity of a parent's power.

II. Literature Review

In this section we review the literature on the following three topics: (a) reasons why bargaining power matters for child well-being, (b) outcomes of shared power between spouses for own well-being(?), and (c) reasons why parents' preferences matters for child well-being.

A recent intervention using a randomized experimental research design found that increasing resources to empower women improved indicators of a woman's own and her children's well-being. Mexico's National Education, Health, and Nutrition Program (PROGRESA) directed cash benefits to mothers if children regularly attended school and health clinics. Evaluators found that over time, the exogenous income transfers to mothers reduced the likelihood that husbands would dictate decisions in five of eight areas of household decision making (taking child to doctor if sick, telling children to go to school, giving children permission to leave, expenses on children's clothing, food expenses, house repairs, durable purchases, how to spend women's extra income) (Adato, de la Briere, Mindek & Quisumbing 2000). Bargaining power was measured by asking mothers about their role in making household economic decisions (Adato et al. 2000). Further, among poorer, more rural households, women used the additional income on clothing for children and meat for consumption, which is presumed to result in better diets (Rubalcava, Teruel & Thomas 2004). The evaluation of PROGRESA did not include anthropometric indicators of nutritional status for children.

Hindin (2000) examined the effect of shared power on the BMI of Zimbabwe women. Women who had no say in household decisions had a nearly 10% lower BMI than women

who had at least some say in household decisions regarding labor, number of children, purchases, and faced a greater likelihood of suffering from chronic energy deficiency (CED), defined as BMI<18.5 (Hindin 2000). Lancaster et al. (2004) found that in households of three Indian states, when decision making power was shared between spouses, there was greater consumption of shared goods – those consumed by everyone in the home – as opposed to luxury goods, such as tobacco and alcohol. Spousal power was measured by the share of total household income controlled by the husbands and the wife (Lancaster et al. 2004). Feyisetan (2000) investigated the importance of joint decision making in contraceptive use among 381 monogamously married Yoruba couples in southwest Nigeria. A bivariate analysis showed that couples who discussed fertility issues were more likely to report use of modern contraceptive methods than their counterparts that do not discuss fertility issues (Feyisetan 2000). Last, among 592 pregnant women who received prenatal services in Nepal, Mullany, Hindin, and Becker (2005) established an association between joint decision making between spouses and the likelihood of planning. For example, couples who communicated were more likely to plan for the possibility of birth complications and discuss transport to the birthing facility. In most of the studies reviewed here, researchers posed questions to spouses, jointly and separately, to identify who the primary decision maker was over certain household decisions.

Finally, we turn our attention to parental preference and children's health. Thomas (1994) used education as a proxy for bargaining power and found that a mother's education had a positive impact on her daughter's standardized z-score for height as opposed to her son's, and that a father's education had a positive impact on his son's standardized z-score for height rather than that of his daughter. This result was found using household data from

Ghana, Brazil, and the United States and suggests that mothers prefer to invest resources in daughters and that fathers prefer to invest resources in sons (Thomas 1994). Among the Tsimane' Indians in the Bolivian Amazon, also used in the present analysis, tests for sex-discrimination between girls and boys reveal that a mother's wealth has a greater positive impact on her daughter's BMI than on her son's BMI (Godoy et. al. 2005a). Using a sample of children under five years of age from South Africa, Duflo (2000) takes advantage of a natural experiment, arising from a change in the government's pension system, to estimate the impact of an exogenous increase in income on the nutritional status of children. Pensions improved the standardized z-score for height of girls such that it reduced the gap with American girls by 50% and the effect was entirely due to pensions received by women as opposed to men (Duflo 2000).

We draw three conclusions from our review. First, most observational studies do not correct for biases stemming from the endogeneity of bargaining power. Studies that use individual well-being as an outcome of individual bargaining power potentially confuse cause with effect. For instance, individual bargaining power might improve individual earnings, but people with higher earnings may feel empowered, and earnings and empowerment might both respond to unmeasured traits, such as the need to achieve, role models in the household, or social norms (Pahl 1983). Second, most studies investigate the link between an individual's bargaining power and that individual's well-being, but have not evaluated the effect of an individual's bargaining power on their children. Given that parents may differ in their preferences, the potential exists for investment discrimination in child well-being. Third, as their primary explanatory variable, these studies either use women's bargaining

power or shared power, but do not consider the different type of power structures which may exist.

In this paper, we supplement the research on bargaining power and intra-household economics by adopting a more holistic perspective on household decision making than is currently observed in the literature. We catalog households into three: those where the mother makes decisions over food acquisition and preparation, those where the father does, and those where both do it jointly. To control for the endogeneity of who wields power over food decisions in a household, we use instrumental variables for each power structure. We estimate the association of each power structure on children's BMI. We also build on the growing recognition observed in studies of bargaining power that people's perception of their control over household economic decisions forms the cornerstone of gauging their power in the home (Hindin 2000; Kantor 2003; Kar, Pascual & Chickering 1999; Stein 1997), but we also ensure that their perceptions match reality (Ashraf 2005).

III. The People

Information for this study is derived from a survey conducted in 2004 among 237 households in 13 villages that straddle the river Maniqui in the province of Beni in the Bolivian Amazon. The latest Bolivian census estimates the Tsimane' population at ~8,000 people (Instituto Nacional de Estadística 2003). The Tsimane' are a typical native Amazonian population. People live in villages of ~18 households along river banks and logging roads. Subsistence centers on hunting, fishing, and slash-and-burn farming. Tsimane' practice cross-cousin marriage, which creates a wide web of relatives linked by

marriage and blood. Residence is matrilocal shortly after marriage, followed by neolocal residence. Tsimane' live in nuclear households and mostly practice monogamy.

In a 1996 survey of 208 households, we found that only 5.31% of households practiced polygyny, and that only 5.72% of household heads lived with their parents. Tsimane' marry within their ethnic group; few marry people from neighboring Amerindian groups, and almost no one marries a non-Amerindian.

Tsimane' remained relatively isolated from outsiders until the 1970s. During the 1970s the opening of roads brought loggers, ranchers, oil firms, and highland colonist farmers into or next to the territory of the Tsimane'. Contact with outsiders involves the sale of rice and forest goods and employment as unskilled laborers. The most important market good Tsimane' acquire is food (e.g., canned meat, oil) followed by clothing.

The 2004 survey formed part of a panel study that had been started in 1999 and continues. The 2004 survey was conducted by experienced interviewers and translators who had been part of the panel study from its start. A discussion of the background to the study and the methods used to collect data can be found in Godoy et. al. 2005b and Godoy et. al. 2005c.

IV. Empirical Approach

We build on the micro-analytic framework of Behrman and Skoufias (2004) to estimate the effect of household power structures on child health. Household welfare is understood as a function of choices for child's health, household leisure, and household consumption of goods and services. Choices, made by household heads, are constrained by a health

production function and budget. We use a collective modeling approach in which the household welfare function is disaggregated into utility functions for individual household members (Vermeulen 2002). As a result, child health not only acts as a constraint on individual utility, but also is subject to preferences as determined by individual characteristics (e.g., income, education). Child health is generated by a production function defined by a vector of health inputs such as diet or immunizations, a vector of child characteristics such as age and sex, environmental or community factors that may have an impact on child's health, and a vector of variables that contains all unobserved child, household, and community characteristics that affect a child's health. We introduce an additional variable into the health production function of a child: a dummy variable characterizing the household power structure type.

We estimate the following model:

$$H_{imfhc} = \beta_0 + \beta_1 X_{1mfhc} + \beta_2 X_{2imfhc} + \beta_3 X_{3imfhc} + \beta_4 X_{4imfhc} + \beta_5 X_{5mhc} + \beta_6 X_{6mhc} + \beta_7 X_{7hc} + \beta_8 X_{8c} + \varepsilon_{imfhc}, \quad (1)$$

where H_{imfhc} is the natural log of BMI of a child *i*, of mother *m* and father *f*, in household *h*, and in community *c*. X_{1mfhc} is a dummy for the type of power structure in the household, defined as a dummy variable for *mother power*, *father power*, or *shared power*. X_{2imfhc} is the age of the child measured in years. X_{3imfhc} is a dummy variable for the child's sex (boy = 1, girl = 0). X_{4imfhc} is the number of days ill the child experienced during the 14 days before the day of the interview. X_{5mhc} is a vector of maternal controls including level of schooling in years, value in bolivianos (1 US dollar = 7.9 bolivianos) of modern durable assets (e.g., watches, radios) owned, and physical stature. Similarly, X_{6mhc} is a vector of paternal controls. X_{7hc} is the total value in bolivianos of all food consumed by the household in the last seven days.

X_{8c} is a vector of 12 dummy variable for villages (n=13-1=12). ε_{imfhc} is the random disturbance term.

V. The Data and Variables

Participants include 229 female and 224 male heads of households who we call mothers and fathers. Of the 237 households, 221 are headed by a mother and father (spouses). Within the 221 households headed by two parents, there are 569 children (279 girls and 290 boys) between two and 13 years of age.

A. Dependent Variable: Body-Mass Index

We use BMI, an anthropometric indicator of short-run nutritional status, as our dependent variable. We do so for four reasons. First, short-run anthropometric indices serve as reasonable proxies for individual well-being across cultures (Kabeer 1999; Sen 1990). Second, low BMI is correlated with an increased risk of premature death and low levels of schooling, and is an early indicator of future chronic health problems (Fogel 1999; Hoddinott & Kinsey 2000). Third, calculation of BMI is based on two simple measures: height and weight. Therefore, BMI is less susceptible to measurement error than other well-being variables. Fourth, since BMI can be reliably calculated for any individual over two years, it has less zero values than other measures of well-being (e.g., years of schooling) that tend to be skewed to the left in poor societies. In our data, the earliest age for which education data is available is 5 years. Nearly 40% of children between ages 5 and 13 have zero years of schooling.

B. Main Explanatory Variable: Household Power Structure Type

To develop a typology of power structures in the household we asked each mother and father separately "Who decides what to buy at the market or what food to cook?" Possible answers included: [1] "I make the decision," [2] My husband/wife makes the decision," and [3] "We make the decision together." Participants' responses clue us into a mother's or a father's perception of decision making in the home, but it may be that his or her spouse does not share in that perception. For example, in some households, the mother and father may both answer that "I make the decision". This results in a conflict over who actually makes the decision. In other households, both may say that their spouse makes the decision. This results in ambiguity over who makes the decision. To overcome the potential bias from responses based on self-perception, we matched the response of a mother or a father with the response of their spouse. When we find that a participant's self-perception of decision making is consistent with the self-perception of the spouse, we have a more reliable measure of decision making in the household.

We create a dummy variable, *agreement*, which we code as +1 for all households where the mother's and father's responses match; the excluded category is all households that disagree on who is the primary decision maker on what food to buy or cook. Next, we create three dummy variables for decision making in the household based on the participant's responses of who is the decision maker: *mother*, *father*, and *shared*. If participants say that the mother makes the decision, then *mother* is coded as +1 for that household and 0 if the mother is not reported as the decider. If participants say that the father makes the decision, then *father* is coded as +1 for that household and 0 if the father is not reported as the decider. If spouses report that they jointly make the decision, then the variable *shared* is coded as +1 and 0 if

mothers and fathers report that they do not jointly decide. Last, we create three interaction terms by multiplying the variable *agreement* with each of the three dummy variables for decision making (*mother*, *father*, *shared*). The interaction terms are our three dummy variables characterizing household power structures: *mother power*, *father power*, and *shared power*. For example, *mother power* is coded as +1 if the mother says she is the main decision maker on what food to buy or cook and her spouse agrees that she, in fact, makes those decisions. *Father power* and *shared power* are similarly coded.

<INSERT TABLE 1 HERE>

Table 1 contains a typology of household power structures in our sample. Based on participant's self-perception of decision making, 187 (44.31%) people said that mothers are the main decision makers, 168 (39.81%) people said that fathers decide, and 67 (15.87%) say that both mother and fathers jointly make decisions about what food to buy or cook. We find that 224 of 422 couples (53.08%) agree over who makes the decision on what food to buy or cook. Of the 224 couples in agreement, 96 (22.74% of total sample) say mothers have the power, 92 (21.80%) say fathers have the power, and 36 (8.53%) say that they share the power.

Since responses are validated between spouses, the construction of our household power variables depicts a more reliable picture of who holds bargaining power on decisions related to food acquisition and preparation in the home. However, we cannot control for unobserved characteristics contributing to household decision making. As a result, biases may exist of unknown magnitude and direction when we estimate the association between power structure and child health. Additionally, women may feel it necessary to credit men

with decision making control when, in fact, it is the woman that decides what food to buy or what to cook. Therefore, we use instrumental variables to redress biases from the endogeneity of household bargaining.

C. Instrumental Variables for Household Power Structure Type

Here we explain the rationale for the use of our instruments. In development studies, researchers have focused on economic resources as determinants of individual bargaining power (Adato et. al. 2000). Doss (1996) uses currently owned assets as a proxy for bargaining power. Haddad and Hoddinott (1995) and Attannasio and Lechene (2002) use the share of income earned by a woman household head as a proxy. The difference in educational attainment between men and women household heads is then used by Haddad and Hoddinott (1995) as an instrument for women's share of income. Given the known problems of measuring income in developing countries (Deaton 1997), we use expenditure as a proxy for income. Physical resources, as measured by age and sex standardized z-scores of anthropometric indicators, may also be correlated with decision making in the household. Low z-scores reflect a lower capacity to contribute to the household via low productivity or low human capital. At the time of writing, we did not find the use of z-scores as proxies of bargaining power in the literature. We are motivated by Hindin (2000) who establishes an association between bargaining power and BMI. Differences in economic and physical resources and the share of household resources in the hands of mothers not only represent the level of inequality between mothers and fathers, but can also shape the power structure of the household. In households where fathers are in control of resources, fathers may maintain bargaining power. The same can be said for mothers. On the other hand, when

there is economic and physical equality between mothers and fathers, control over economic decisions may be shared since each parent equally contributes to total household well-being.

Possible instrumental variables for household power structure type include: the difference in education, expenditure, weight-for-age z-score, and height-for-age z-score between fathers and mothers of a household; the proportion of household assets owned by the mother; and the mother's share of total household expenditure in the last 14 days and expenditure on durable goods in the last year. Columns a-c, Table 2, contain the results of the reduced-form regressions.

We regress the outcome variable, logarithm of BMI, against the potential instrumental variables (just discussed) plus the child's age, sex, days ill, maternal controls, paternal controls, household food consumption, and village dummies (the covariates of BMI). We show the results in columns d-f of Table 2.

<INSERT TABLE 2 HERE>

The results in Table 2 suggest that some of our potential instruments are significantly associated with the household power structures, but not with our outcome variable, the logarithm of BMI. When we use *shared power* (column a) as an outcome variable, we find that two potential instrumental variables – difference in education and mother's proportion of expenditure – overlapped well with shared power at the 95% confidence level or higher. When *mother power* (column b) is an outcome variable, we find that three potential instrumental variables – difference in z-score for height, and mother's proportion of wealth and expenditure – overlapped well with mother power at the 95% confidence level of higher. Last, when we use *father power* as an outcome, we find that four potential instrumental

variables – difference in education and z-score for height, and mother's proportion of wealth and household expenditure on durable goods – are each associated with *father powe*r at the 95% confidence level or greater.

The last three columns of Table 2 (d-f) contain ordinary least square regression results with the logarithm of BMI as the dependent variable; as explanatory variables we include *shared power* or *mother power* or *father power*, the significant instruments from the reduced-form equations (columns a-c, Table 2), and the covariates of BMI. The results suggest that none of the potential instrumental variables bear a statistically significant relation with the logarithm of BMI. Therefore, sensible instrumental variables for *shared power* include: (1) the difference in education between the mother and father and (2) mother's proportion of household expenditure. For *mother power*, (1) difference in z-score for height between mother and father, (2) mother's proportion of total modern assets in the household, and (3) her proportion of total household expenditure emerge as instrumental variables. Last, the results suggest that (1) difference between mothers and fathers in expenditure in durable assets, (2) difference between mothers and fathers in z-score for height, and (3) mother's proportion of total household expenditure in the last two weeks and (4) expenditure in durable goods in the last year are reasonable instrumental variables for *father power*.

<INSERT TABLE 3 HERE>

Since we have multiple instruments for each of our endogenous variables, we test for the validity of over-identifying restrictions when we present the main regression results (Wooldridge 2003; Baum, Schaffer and Stillman 2003) and find high p values, so we do not reject the overidentifying restrictions. Table 3 contains definition and summary statistics of the instrumental, dependent, and explanatory variables used in the regression analysis.

VI. The Results

The mean BMI of all children in the sample is 16.90 (sd = 1.65), of girls is 16.80 (sd = 1.75) and of boys is 16.99 (sd = 1.46). A two sample t-test between girl's and boy's BMI showed that the mean difference was statistically insignificant (t = -1.27). A similar test between the BMI of children whose parents agree on food decisions and those that do not, suggests that there is no statistical difference between the two groups (t = 0.59).

Table 4 contains the main OLS and two-stage least squares regression results. Beginning with the OLS results (columns a, c, and e), we find that *shared power* between mothers and fathers (column a) is associated with 3.4% higher BMI in children relative to children in households where parents do not share power. This result is significant at the 95% confidence level. A noteworthy finding is the association of *mother power* (column c) with children's BMI; a mother with bargaining power has no effect on children's BMI. This is also true of households where fathers make the decision (column e). The result for *shared power* remains significant when we use instrumental variables (column b). Column d suggests that children, whose mother holds the power over what food to buy or cook, have 3.0% lower BMI than children whose mother does not have that power.

Based on the two-stage least squares result for *shared power*, children whose parents jointly make decisions have a 3.9% higher BMI than children of parents where either the mother or the father make the decisions about what food to buy or cook. Given that the mean BMI for children is 16.90 (sd = 1.46), a 3.9% increase translates to a 0.65 kg/m^2 increase – a wisp of an effect on children's nutrition.

<INSERT TABLE 4 HERE>

We re-estimate our model, but for girls and boys separately. Table 5 contains the OLS and two-stage least square estimations for the impact of *shared power*, *mother power*, and *father power* on girl's and boy's BMI. The most notable finding here is that the instrumental variable coefficients in columns c and d representing the impact of *shared power* on girl's and boy's BMI. The impact on girls and boys is almost identical, 4.5% for boys and 4.6% for girls. Both are significant at the 90% confidence level. This result suggests when mothers and fathers jointly make decisions about what food to buy or cook there is less girl-boy inequality in BMI.

VII. Extensions

To test for robustness in our results, we re-estimate the OLS results of columns a, c, and e in Table 4 with variations to our core model from equation 1. Table 6 contains these results. Since children in a village are likely to have similar BMI because of village characteristics affecting all children, we control for village heterogeneity by clustering at the village level. The effect of *shared power* on children's nutrition does not change in magnitude and remains significant at the 95% confidence level (column a). Because many studies suggest that income inequality might affect nutritional status, we condition for village income and wealth inequality using the Coefficient of Variation and the Gini index of inequality. We remove the village dummies from the core model, and one-by-one, re-estimate equation 1 with the different indices of village inequality. The new coefficients (columns b, c, and d) for *shared*

power are larger in magnitude (range from 4.0% to 4.2%) and increase in significance to the 99% confidence level.

Our analysis may be subject to biases from omitted variables. It may be that we did not choose the right parental characteristics as controls in our estimation. We add a full set of variables for parental human capital and parental social capital. Variables for parent's human capital included the level of schooling attainment in years, the ability to speak Spanish, math skills, and writing skills. Variables for parent's social capital included the total number of times gifts or help were given to all other Tsimane'. The additional parental controls do not change our results (columns e and f).

Biases may also arise from household size or the number of children in the household. Smaller households, with fewer children, may be positively correlated with shared power and positively correlated with children's BMI. We re-estimate equation 1 with household size and the number of children. Our original impact of shared power on children's BMI is unaffected (columns g and h).

Last, we tested whether the results would hold with other outcomes besides BMI. We re-estimated regressions using children's standardized z-scores for mid-arm muscle area, triceps and subscapular skinfolds, height-for-age, and weight-for-age. We find no effect of *shared power* on mid-arm muscle area, height, or weight (columns i, k and l). Shared power over decisions on food acquisition and preparation is associated with a 0.21 standard deviation increase in a child's standardized z-score for subscapular skinfolds relative to children whose parents do not share power (column j). This result is significant at the 90% confidence level.

VIII. Discussion and Conclusion

In the literature, discussions regarding power over household economic decisions revolve around the mother (Blumberg, Rakowski, Tinker & Monteon 2005). Researchers find that the household does not act in unison and that parents differ in their patterns of consumption, investment, production, expenditure, and decisions (Ashraf 2005; Duflo & Udry 2003; Dwyer & Bruce 1988; Lundberg & Pollak 1996). A woman's pattern of household economic behavior and her bargaining power are recognized as determinants of well-being for both herself and her children, but formal tests of this hypothesis have shown that this is not always the case (Haddad & Hoddinott 1994; Rubalcava, Teruel & Thomas 2004; Thomas 1994; Schuler, Hashemi & Riley 1997; Brown & Park 2002; Jewkes 2002). Even though the empirical evidence is ambiguous, the common policy prescription is to shift resources into the hands of women to increase her power in the household.

Results in Table 4 suggest that power over economic decisions regarding food is not favorable for children's nutritional status when held solely by the mother or father. We find that when parents share power over what food to buy or what to cook, children enjoy slightly better BMI than their counterparts whose parents do not share power. The magnitude of the improvement is small, about 3.9%. Our result for mother's power is not unique to the Tsimane', but has been found in other studies. For example, Mullany, Hindin and Becker (2005) show that for each additional decision controlled by a woman, her husband was less likely to participate in prenatal care. They conclude that since many family planning programs are dependent on spousal communication and cooperation, increased women's autonomy may hinder program success.

Table 5 shows that when parents share power in decisions over food acquisition and preparation, girl and boy benefit equally. Much empirical evidence shows preferential investment in children of one sex over the other by either the mother or the father, but Behrman and Skoufias (2004) note that most studies that find son preference come from South Asia. The authors review eight Latin American studies on the determinants of child health and find lack of son preference. Our result meshes with the findings of Berhmand and Skoufias. Additionally, discrimination may be relative to the type of decision or investment that is made. For example, Ayalew (2005) shows that equity concerns are stronger in health decisions than in education decisions for parents in Ethiopia. We did not analyze human capital outcomes here, but we do find a preference for equity in child nutritional status, as Ayalew (2005) suggests.

The fact that Tsimane' parents exhibit inequality aversion in health related outcomes between girl and boy children when parents share power is instructive for future quantitative household research. It may not be the case that increased bargaining power of one household head is best for total household well-being. Our conclusions may be validated further or refuted by an analysis of child health outcomes as a result of an exogenous income shock in Tsimane' households that share power. Also, repeated measurements of household decision making and child BMI will help us understand their association from one period of time to the next. Finally, study designs that investigate the three types of household power structures, as we have done here, will broaden our understanding of bargaining patterns across cultures. The possible policy implications are significant. Policies designed to empower individuals should be cautious of the potential costs of placing too much control

in the hands of a single person in the household. Policies that encourage spouses to cooperate and share power over household resources may translate into better child well-being and be an important approach for removing discrimination among children in household resource investment by parents.

Bibliography

Adato, M., de la Briere, B., Mindek, D., & Quisumbing, A.R. (2000). The impact of PROGRESA on women's status and intrahousehold relations. Washington, D.C.: International Food Policy Research Institute.

Agarwal, B. (1997). 'Bargaining' and gender relations: Within and beyond the household. *Feminist Economics* 3(1), 1-51.

Al Riyami, A., Afifi, M., & Mabry, RM. (2004). Women's autonomy, education and employment in Oman and their influence on contraceptive use. *Reproductive Health Matters*, 12(23), 144–154.

Alderman, H., Chiappori, P., Haddad, L., Hoddinott, J., & Kanbur, R. (1995) Unitary versus Collective Models of the Household: Is It Time to Shift the Burden of Proof?. *World Bank Res Obs*, 10, 1-19.

Ashraf, N. (2005). *Spousal control and intra-household decision making: An experimental study in the Philippines [dissertation]*. Department of economics, Harvard University.

Attanasio, O., & Lechene, V. (2002). Tests of income pooling in Household Decisions. *Review of Economic Dynamics*, 5(4), 720-48.

Baum, C.F., Schaffer, M.E., & Stillman S. (2003). *Instrumental variables and GMM: Estimation and Testing*. Working Paper No. 545. Department of Economics, Boston College.

Behrman, J.R., & Skoufias, E. (2004). *Correlates and determinants of child anthropometrics in Latin America: background and overview of the symposium*. Economics and Human Biology, 2, 335-351.

Blumberg, R.L., Rakowski, C.A., Tinker, I., & Monteon, M. (2005). *Engendering Wealth and Well-Being. Boulder*. Colorado: Westview Press.

Brown, P.H., & Park, A. (2002). Education and poverty in rural China. *Economics of Education Review*, 21, 523-41.

Deaton, A. (1997). *The Analysis of Household Surveys: A Microeconometric Approach to Development Policy*. Baltimore: Johns Hopkins University Press.

Doss, C. (1996). *Women's bargaining power in household economic decisions: Evidence from Ghana*. Staff Paper Series No. P96-11. Department of Applied Economics, College of Agricultural, Food, and Environmental Sciences, University of Minnesota.

Duflo, E. (2000). Child Health and Household Resources in South Africa: Evidence from the Old Age Pension Program. *The American Economic Review*, 90(2), 393-398.

Duflo, E., & Udry, C. (2003). *Intrahousehold resource allocation in Cote D'Ivoire: Social norms, separate accounts and consumption choices*. Cambridge, MA: Bureau for Research in Economic Analysis of Development; Report nr 016.

Dwyer, D., & Bruce, J. (1988). *A Home Divided: Women and Income in the Third World*. Palo Alto, California: Stanford University Press.

Estudillo, J., Quisumbing, A., & Otsuka, K. (2001). Gender Differences in Land Inheritance, Schooling and Lifetime Income: Evidence from the Rural Philippines. *Journal of Development Studies*, 37(4), 23.

Feyisetan, B.J. (2000). Spousal communication and contraceptive use among the Yoruba of Nigeria. *Population Research and Policy Review*, 19, 29-45.

Fogel, R.W. (1989). Catching up with the economy. *The American Economic Review*, 89(1), 1-21.

Godoy, R., Reyes-Garcia, V., Huanca, T., Leonard W.R., McDade T., Tanner, S., & Vadez, V. (2005a). Why do mothers favor girls and fathers boys? A hypothesis and test of intra-household girl-boy investment disparity. *Human Nature*. In press.

Godoy, R., Reyes-Garcia, V., Vadez, V., Leonard, W.R., Huanca, T.L., & Bauchet, J. (2005b). Human capital, wealth, and nutrition in the Bolivian Amazon. *Economics and Human Biology*, 3, 139-62.

Godoy, R., Byron, E., Reyes-Garcia, V., Vadez, V., Leonard, W.R., Apaza, L., Huanca, T., & Perez, E. (2005c). Income inequality and adult nutritional status: Anthropometric evidence from a pre-industrial society in the Bolivian Amazon. *Social Science & Medicine*, 61(5), 907-19.

Haddad, L., & Hoddinott, J. (1994). Women's income and boy-girl anthropometric status in the Cote d'Ivoire. *World Development*, 22(4), 543-53.

Hindin, M.J. (2000). Women's power and anthropometric status in Zimbabwe. *Social Science & Medicine*, 51(10), 1517-28.

Hindin, M.J. (2002). For Better or for Worse? Women's Autonomy and Marital Status in Zimbabwe. *Social Science Research*, 31(1), 151-172.

Hoddinott, J., & Haddad, L. (1995). Does Female Income Share Influence Household Expenditures? Evidence from Côte D'Ivoire. *Oxford Bulletin of Economics and Statistics*. 57(1), 77-96.

Hoddinott, J., & Kinsey, B. (2000). *Adult health in the time of drought*. Washington, D.C.: International Food Policy Research Institute.

Instituto Nacional de Estadística. (2003). *Bolivia: características sociodemográficas de la población indígena*. La Paz: INE.

Jewkes, R. (2002). Intimate partner violence: Causes and prevention. *The Lancet*. 359. 1423-9.

Kabeer, N. (1999). Resource, agency, achievements: Reflections on the measurement of women's empowerment. *Development and Change*, 30, 435-64.

Kantor, P. (2003). Women's empowerment through home-based work: Evidence from India. *Development and Change* 34(3), 425-45.

Kar, S.B., Pascual, C.A., & Chickering, K.L. (1999). Empowerment of women for promotion: A meta-analysis. *Social Science & Medicine* 49, 1431-60.

Lancaster, G., Maitra, P., & Ray, R. (2004). *Endogenous Intra Household Balance of Power and its Impact on Expenditure Patterns: Evidence from India*. Paper presented at the Annual Meeting of the European Society of Population Economics held in Bergen, Norway in June, 2004.

Lundberg, S., & Pollak, R.A. (1996). Bargaining and distribution in marriage. *Journal Economic Perspectives.* 10(4), 139-58.

Mullany, B., Hindin, M., & Becker S. (2005). Can women's autonomy impede male involvement in pregnancy health in Katmandu, Nepal?. *Social Science & Medicine*, 61(9), 1993-2006.

Pahl, J. (1983). The allocation of money and the structuring of inequality within marriage. *The Sociological Review* 31(2), 237-62.

Quisumbing, A. (1994). Intergenerational Transfers in Philippine Rice Villages: Gender Differences in Traditional Inheritance Customs. *Journal of Development Economics*. 43(2), 167–196.

Rangel, M. (2003). *Alimony Rights and Intrahousehold Bargaining: Evidence from Brazil*. California Center for Population Research. On-Line Working Paper Series. Retrieved on May 5, 2005 from http://repositories.cdlib.org/.

Rubalcava, L., Teruel, G., & Thomas, D. (2004). *Spending, Saving and Public Transfers Paid to Women*. California Center for Population Research. On-Line Working Paper Series. Retrieved on May 5, 2005 from http://repositories.cdlib.org/.

Schuler, S.R., Hashemi, S., & Riley, A.P. (1997). The influence of women's changing roles and status in Bangladesh's fertility transition: Evidence from a study of credit programs and contraceptive use. *World Development*, 25, 563-75.

Schultz, P.T. (1990). Testing the Neoclassical Model of Family Labor Supply and Fertility. *The Journal of Human Resources*, 25(4), 599-634.

Sen, A. (1990). *Gender and co-operative conflict*. In: Tinker I, editor. Persistent Inequalities. Oxford: Oxford University Press, 123-149.

Stein J. 1997. *Empowerment and women's health: Theory, methods, and practice*. London: Zed Books.

Thomas, D. (1990). Intra-Household Resource Allocation: An Inferential Approach. *The Journal for Human Resources*, 25(4), 634 – 664.

Thomas, D. (1994). Like Father, like Son; Like Mother, like Daughter: Parental Resources and Child Height. *The Journal for Human Resources*, 29(4), 950-988.

Wooldridge, J.M. (2003). *Econometric Analysis of Cross Section and Panel Data.* Cambridge, MA: MIT.

Vermeulan, F. (2002). Collective Household Models: Principles and Main Results. *Journal of Economic Surveys*, 16(4), 533 – 564.

Table 1:
Typology of power structures

	Before match		After match	
Power Structure Type	N	%	N	%
Shared	67	15.87	36	8.53
Mother	187	44.31	96	22.74
Father	168	39.81	92	21.80
Total	422	100.00	224	53.08

Table 2

Testing of adequacy of instrumental variables: Results of multinomial logit and OLS regressions

	Dependent Variables:					
	Power Structure			Anthropometric Index		
	Shared	Mother	Father	Log BMI	Log BMI	Log BMI
Variables:	[a]	[b]	[c]	[d]	[e]	[f]
Power structure:						
Shared	^	^	^	0.042 (0.018)**	^	^
Female	^	^	^	^	-0.022 (0.012)*	^
Male	^	^	^	^	^	-0.019 (0.014)
Potential instrumental variables:						
Difference:						
Expenditure in last 14 days in Bs	-0.001 (0.002)	-0.001 (0.001)	0.006 (0.002)***	^	^	-0.019 (0.014)
Education in years	-0.42 (0.214)**	0.066 (0.075)	-0.077 (0.17)	-0.0001 (0.003)	^	^
Z-score for weight	-0.698 (0.499)	-0.08 (0.307)	0.022 (0.375)	^	^	^
Z-score for height	-0.39 (2.537)	-3.969 (1.56)**	4.365 (2.098)**	^	-0.002 (0.041)	0.018 (0.041)
Female Proportion of :						
Modern assets in household in Bs	-7.386 (4.543)	-8.891 (2.755)***	8.291 (2.733)***	^	-0.022 (0.063)	-0.003 (0.063)
Total value of household expenditure in Bs	3.089 (1.217)**	1.892 (0.773)**	-1.849 (1.296)	-0.024 (0.022)	-0.011 (0.022)	^
Total value of household expenditure on durable goods in Bs	-1.461 (1.984)	0.407 (0.93)	-4.801 (1.612)***	^	^	-0.024 (0.029)
N	158	268	206	369	369	369
Psuedo R2	0.3523	0.1991	0.2508	0.1943	0.1893	0.1853

Note: Regressions are OLS with constant (not shown). Control variables not shown include age, sex, days ill; mother's and father's: education, wealth, durable expenditures, stature; total household food consumption, distance to nearest town, and a full set of village dummies. In cells we show coefficients and, in parenthesis, standard errors. *, **, and *** significant at the 10%, 5%, and 1% level. ^ = variable intentionally left out.

Table 3
Summary statistics of variables used in regressions

Defintion of variables:	**N**	**Mean**	**Standard deviation**
Outcome variable			
Log of child's BMI (body-mass index, kg/m^2)	516	2.82	0.09
Explanatory variables			
Shared power structure (see text)	516	0.09	0.28
Female power structure (see text)	516	0.25	0.43
Male power structure (see text)	516	0.23	0.42
Control variables			
Age of the child in years	516	7.10	3.22
Sex of the child (male=1, 0 otherwise)	516	0.51	0.50
Number of self reported days ill in the last two weeks	516	2.73	4.59
Mother's highest level of schooling	516	1.04	1.46
Father's highest level of schooling	516	2.40	3.08
Mother's value of modern assets in bolivianos ($1US = $7.8Bs) (see note)	516	348.78	423.29
Father's value of modern assets in Bs	516	1456.29	819.62
Mother's expenditure on durable goods in the last year in Bs	516	80.58	231.18
Father's expenditure on durable goods in the last year in Bs	516	365.21	605.17
Mother's stature (cm)	516	151.56	4.53
Father's stature (cm)	516	162.62	4.87
Total value of household food consumption in last week in Bs	516	671.74	296.92
Potential instrumental variables			
Difference (see text):			
Expenditure in last 14 days in Bs	516	69.37	162.88
Education in years	516	1.36	3.01
Z-score for weight	516	-0.44	0.69
Z-score for height	516	-0.18	0.89
Female Proportion of (see text):			
Modern assets in household in Bs	516	0.18	0.17
Total value of household expenditure in Bs	378	0.15	0.26
Total value of household expenditure on durable goods in Bs	499	0.18	0.28

Table 4

Effect of Household Power Structure over Food Decisions on Children's Nutritional Status (ages 2-13): Ordinary-least squares (OLS) and instrumental-variable (IV) estimations, Tsimane' Amerindians, Bolivia, 2004

	Dependent Variables:					
	Log BMI		Log BMI		Log BMI	
	OLS	IV	OLS	IV	OLS	IV
Explanatory Variables:	[a]	[b]	[c]	[d]	[e]	[f]
Shared	0.034 (0.015)**	0.039 (0.017)**	^	^	^	^
Mother	^	^	-0.015 (0.009)	-0.030 (0.116)***	^	^
Father	^	^	^	^	-0.006 (.010)	-0.014 (0.013)
N	516	378	516	378	516	369
R2	0.1279	0.1745	0.1240	0.1786	0.1203	0.1803
IV	^	A	^	B	^	C
Over-Identification Test (Sargan)	^	0.2043	^	0.7909	^	0.7360

Note: Regressions are OLS and IV with constant (not shown). Control variables not shown include age, sex, days ill; mother's and father's: education, wealth, durable expenditures, stature; total household food consumption, distance to nearest town, and a full set of village dummies. In cells we show coefficients and, in parenthesis, standard errors. *, **, and *** significant at the 10%, 5%, and 1% level. ^ = variable intentionally left out.

A - difference in parent's education and mother's proportion of household expenditure in last two weeks;

B - difference in z-score for height, mother's proportion of total household wealth in modern assets, and mother's proportion of household expenditure in last two weeks;

C - difference in household expenditure, difference in z-score for height, mother's proportion of durable expenditure in last year, and mother's proportion of expenditure in last two weeks.

Table 5

Effect of Household Power Structure over Food Decisions on Children's Nutritional Status (ages 2-13) by Gender: Ordinary-least squares (OLS) and instrumental-variable (IV) estimations, Tsimane' Amerindians, Bolivia, 2004

	Dependent Variables:											
	Log BMI				Log BMI				Log BMI			
	OLS		IV		OLS		IV		OLS		IV	
Explanatory Variables:	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl
	[a]	[b]	[c]	[d]	[e]	[f]	[g]	[h]	[i]	[j]	[k]	[l]
Shared	0.034 (0.022)	0.043 (0.022)*	0.045 (0.024)*	0.046 (0.025)*	^	^	^	^	^	^	^	^
Mother	^	^	^	^	-0.007 (0.012)	-0.005 (0.019)	-0.014 (0.016)	-0.028 (0.018)	^	^	^	^
Father	^	^	^	^	^	^	^	^	-0.003 (0.013)	-0.016 (0.016)	-0.024 (0.017)	-0.01 (0.020
N	264	252	188	190	264	252	188	191	264	252	184	190
R2	0.1277	0.231	0.1581	0.3127	0.1206	0.2192	0.1441	0.3091	0.1195	0.2222	0.1576	0.2999
IV		^	A	B	^	^	C	C	^	^	D	B
Over-Identification Test (Sargan)	^	^	0.268	^	^	^	0.3513	0.2176	^	^	0.4100	^

Note: Regressions are OLS and IV with constant (not shown). Control variables not shown include age, sex, days ill; mother's and father's: education, wealth, durable expenditures, stature; total household food consumption, distance to nearest town, and a full set of village dummies. In cells we show coefficients and, in parenthesis, standard errors. *, **, and *** significant at the 10%, 5%, and 1% level. ^ = variable intentionally left out. IV's used in regressions are as follows:

A - difference in parent's education and mother's proportion of expenditure in last two weeks;

B - mother's proportion of expenditure in last two weeks;

C - difference in z-score for height, mother's proportion of wealth, and mother's proportion of expenditure in last two weeks;

D - difference in z-score for height, mother's proportion of durable expenditure in last year, and mother's proportion of expenditure in last two weeks.

Table 6

Tests for robustness. Ordinary-least squares (OLS) estimations, Tsimane' Amerindians, Bolivia, 2004

	Dependent Variables:											
	Log BMI								Z-scores			
	Village				Parents		Household		Children's			
Explanatory Variables:	Clustering	Income gini	Income coefficient of variation	Wealth coefficient of variation	Human capital	Social capital	Size	No. of children	Mid-arm muscle area	Subscapular skinfolds	Height-for-age	Weight-for-age
	[a]	[b]	[c]	[d]	[e]	[f]	[g]	[h]	[i]	[j]	[k]	[l]
Shared Power	0.034 (0.012)**	0.041 (0.015)***	0.040 (0.015)***	0.042 (0.015)***	0.030 (0.016)*	0.036 (0.022)**	0.037 (0.016)**	0.035 (0.015)**	0.124 (0.125)	0.213 (0.110)**	-0.030 (0.204)	0.051 (0.131)
N	516	516	516	516	514	516	516	516	514	495	519	516
R2	0.1279	0.0958	0.0961	0.0968	0.1474	0.1344	0.1345	0.1297	0.1793	0.4044	0.1188	0.1046

Note: Regressions are OLS with constant (not shown). Control variables not shown include age, sex, days ill; mother's and father's: education, wealth, durable expenditures, stature; total household food consumption, distance to nearest town, and a full set of village dummies. In cells we show coefficients and, in parenthesis, standard errors. *, **, and *** significant at the 10%, 5%, and 1% level. ^ = variable intentionally left out.