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*Parental preference, bargaining power, and child nutritional status:
Evidence from the Bolivian Amazon*

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Executive Summary

In recent years, analysts have examined the effects of bargaining power on individual well-being. Here we build on this line of research by estimating the effects of three types of household power structures on children's well-being in a highly autarkic society of foragers and horticulturalists in the Bolivian Amazon, the Tsimane'. We overcome biases from self-perceived measures of bargaining power in two ways. First, by matching the responses of the two spouses to questions about who makes household economic decisions related to food acquisition and preparation. Second, we use parental attributes characterizing own welfare as instrumental variables for bargaining power. We split households into those where the mother, the father, or both jointly make decisions. Using data from a survey done in 2004, we regress a proxy for well-being, the body-mass index (BMI; kg/m^2), of 569 Tsimane' children under 13 years of age belonging to 221 pairs of mothers and fathers on the following variables: a dummy variable for household power structure, the child's age, sex, schooling, perceived days ill, mothers' characteristics, fathers' characteristics, 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 power of household economic decisions 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 end with a discussion of why shared power over household economic decisions may result in healthier children regardless of the sex of the child and why development projects that aim to shift household resources to strengthen an individual's bargaining power should be cautious of empowering only one individual in the home.

I. Learning objectives

- To increase my analytical capacity in the application of econometric and GIS analysis, specifically in the field of household economics.
- To gain a theoretical and rigorous empirical foundation of the causes and consequences of preferences and inequality in households and the implications on development policy.
- To discover new ways one can combine rigorous analytical techniques with advocacy in applied development work.

I believe that each of us, as development practitioners, owe it to each other and our field, to develop and harness the natural ability we possess to further social justice. I did not come to Brandeis University thinking I would be a primarily technical individual, but it became quickly apparent to me where my ability, and subsequently, my responsibility lie.

A common theme through the first year of study was the importance of ‘evidence’ in our work. The Heller School motto is *Knowledge advancing social justice*. As a student, my professors have emphatically stressed the importance of evidence in my work. Yet, my real-world experience as a development professional does not mesh with this standard. I do not presume that development is a haphazard affair, but I am sure that there are numerous examples of where a policy was not supported by the available evidence

Development is messy and it is hard to simplify the complexities of poverty into an equation. Nonetheless, the necessity of evidence-based development policy became very clear to me after my first year of coursework. There must be a space for rigorous research and effective development action to meet. Furthermore, the idea of *sustainability* is intertwined with the idea of *truth*; the goal of empirical science. The tools of science are rarely visible in development work, but I believe that my second year project will help me connect the two by building technical skills. I hope to occupy the space between development research and development action, being well versed in both, and dedicated to their mutual goals of truth, justice, and equality.

II. Problem description

Recent research suggests that bargaining power over household economic decisions affects child well-being. Sociologists, and more recently, economists, have also put forth the idea that united households - ones in which spouses agree - produce better outcomes for children than divided households – ones in which spouses disagree.

The type of household power structure is relevant to sustainable development policy. An increasing number of development projects aim to reduce the income disparity between women and men. The projects attempt to place greater resources in the hands of women, thereby increasing their bargaining position. Research suggests women’s control of household resources translates into positive benefits for her children. However, this

approach assumes that women and men make decisions independent of each other and neglects the possibility of joint decision making, communication, and income pooling. Furthermore, such action runs the risk of driving a harmful wedge between family members. If it is the case that women and men make decisions through a bargaining process, reach an agreement, and pool resources, then increased resources solely in the hands of women will not yield the most beneficial returns on child well-being.

III. Introduction

The idea that all members of a household equally share goals, labor and resources, and are altruistic, has been widely refuted in empirical work (Alderman, Chiappori, Haddad, Hodinott & Kanbur 1995; Schultz 1990; Vermeulan 2002). Current economic models of the household use a disaggregated version of the traditional household unitary utility model. Here, total household utility is a function of each household head's or each parent's utility. As a result, resources, goods, and services invested in a child of the household are determined by a parent's utility function. Since individual preferences shape individual utility, parental utility functions need not be the same between spouses (Chiappori 1988; Manser & Brown 1980). Consequently, outcomes of parent's actions can have varying effects in the home. A common result in empirical work is to find that resources controlled by women, as opposed to men, lead to greater well-being for her and her children (Alderman et. al. 1995; Thomas 1990).

To exercise preferences, individuals must have the ability to do so. Economists have proposed game-theoretic models to explain intrahousehold decision making and resource distribution in light of individual preferences (Agarwal 1997; Chiappori 1988; Manser & Brown 1980). Vermeulan (2002) discusses these approaches, generally named collective household models, in detail and explains that bargaining power is characterized by a person's well-being. An increase in individual well-being may result in a shift of bargaining power over household economic decisions to favor that individual. This in turn, due to differing parental preferences, will re-distribute resources among children in the household such that it maximizes their own utility.

In this paper we ask a simple but important question: What type of household power structure 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 - as a proxy for child well-being (Kabeer 1999; Sen 1990). 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 or mother exercises most of the decisions. In the third, the father and the mother share in the power equally through joint decision making. This paper is unique because rarely are all three power structures analyzed in parallel; the usual outcome investigated is individual, typically women's, well-being as a result of acquiring greater bargaining power whereas here we investigate children's well-being (Hindin 2000). We ensure that our measure of a person's power has roots in reality and does not merely reflect a person's perception. We use instrumental variables to correct for the endogeneity of a person's power.

Results suggest that (1) shared power between mothers and fathers is associated with 3.9% ($p=0.02$) higher child BMI; (2) mother's power is associated with 3.0% ($p=0.01$) lower BMI; (3) the BMI of sons and daughters do not differ in households where parents share power. Results were robust to many tests, including controls for village, household, and parental heterogeneity.

IV. Related work

Substantial scholarship on household economics has lifted the veil from over the household to study the demand for education, health, labor, fertility, home production, migration, child fostering, and agricultural output. 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, and (c) reasons why parents' preferences matters for child well-being.

A. Why bargaining power matters for children's well-being?

Observational studies yield imprecise estimates of the associations between bargaining power and well-being because they cannot control for the endogeneity of empowerment (Lambert, Millimet & Slottje 2005; Nanda 1999; Scanlan 2004; Zimmerman 1990). A recent intervention using a randomized experimental research design found that directing 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, named PROGRESA, directes cash benefits, linked to children's school and clinic attendance, to mothers. 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 (e.g., telling children to go to school, food expenses, house repairs, durable purchases) (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). Furthermore, among poorer, more rural households, women used the additional income on clothing for children and meat, which is presumed to result in better diets (Rubalcava, Teruel & Thomas 2004). Due to the lack of anthropometric data, the actual anthropometric impact of bargaining power is not investigated in PROGRESA households.

B. Why shared power matters for individual well-being?

Shared power between spouses has been associated with improved nutritional status of women (Hindin 2000), consumption of increased public goods in the household (Lancaster, Maitra & Ray 2004), contraceptive use of parents (Feyisetan 2000), and preventive health practices of expecting parents (Mullany, Hindin & Becker 2005).

Hindin (2000) examined the relationship of shared power and own 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, and purchases, and faced a greater likelihood of suffering from chronic energy deficiency (CED), defined as BMI < 18.5 (Hindin 2000). In households of three Indian states, when decision making power is shared between spouses there is greater consumption of shared goods – those consumed by everyone in the home – as opposed to luxury goods, such as tobacco and alcohol (Lancaster et. al. 2004). Lancaster *et. al.* (2004) measured spousal power by husbands' and wives' share of total household earnings. Feyisetan (2000) investigated the importance of spousal communication 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 (Feyisetan 2000). Last, among 592 pregnant women who received prenatal services, Mullany, Hindin and Becker (2005) established an association between joint decision making in the home and the likelihood of planning for birth complications, location and transport to the birthing facility, acquiring a safe delivery kit, financing, and identification of a blood donor in case of emergency. In most of the studies just reviewed, researchers posed questions to spouses, jointly and separately, to identify who the main decision maker was. None of the researchers controls for the endogeneity of bargaining power between spouses.

C. Why preferences matter for children's well-being?

Parental preference has been associated with inequality in children's educational attainment (Rangel 2004), parents' schooling investment among children (Ayalew 2005), and land inheritance (Quisumbing 1994; Estudillo, Quisumbing & Otsuka 2001). For brevity, we focus our attention of works related to outcomes of child health.

Thomas (1994) uses education as a proxy for bargaining power and found mother's education had a positive impact on her daughter's standardized z-score for height as opposed to her son's, and a father's education had a positive impact on his son's standardized z-score for height rather than his daughter's. 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 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 finds 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 to estimate the impact of an increase in income from a new government pension program on the nutritional status of children. Pensions improved girl's standardized z-score for height 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 studies do not account for bias arising from the endogeneity of bargaining power. Studies that use individual well-being as an outcome of bargaining power potentially confuse cause with effect. For instance,

individual bargaining power might improve individual earnings, but people with higher earnings might 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 individual bargaining power and individual well-being and have not looked at effects among other household members. Given that individual preferences shape health outcomes of children, to advance empirical understanding of household power structures, one must draw causality that runs varying power structures to children's nutrition. Third, an exhaustive accounting of household power structure types in a society and a comparative analysis of their outcomes is not seen in the literature.

In this paper, we contribute to the research on bargaining power and intrahousehold economic behavior by estimating the impact of different household power structures on child health. To control for the endogeneity of bargaining power in a household, we use instrumental variables for households where decision making control over food acquisition and preparation is held by the mother, the father, and when spouses jointly decide. We estimate the returns to children's BMI – a short-run nutritional indicator - from the three type of household power. We also build on the growing recognition in studies of power that people's perception of their empowerment forms the cornerstone for gauging empowerment (Hindin 2000; Kantor 2003; Kar, Pascual & Chickering 1999; Stein 1997), but we also make sure their perceptions match reality (Ashraf 2005).

V. 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. Households achieve a welfare level based on choices for child's health, household leisure, and household consumption of goods and services. Choices, made by household heads, are subject to a health production function and budget constraint. We use a collective modeling approach where 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: *household power structure*.

We estimate the following model:

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

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 the type of power structure in the household, defined as a dummy variable for *mother power*, *father power*, or *shared power*. X_{2mfhc} is the age of the child measured in years. X_{3mfhc} is a dummy variable for the child's sex (boy = 1, girl = 0). X_{4mfhc} is the number of self-reported 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 boliviano (1 US dollar = 7.9 boliviano) of modern durable assets (e.g., watches, radios) owned, and physical stature. X_{6mhc} is a vector of paternal controls including level of schooling in years, value in boliviano of modern durable assets owned (e.g., watches, radios), and physical stature. X_{7hc} is the total value in boliviano 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.

VI. The people, data and variables

Information for the article comes from a survey done in 2004 among 237 households in 13 villages straddling the river Maniqui, province of Beni, in the Bolivian Amazon. The latest Bolivian census puts 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 matrilineal shortly after marriage, followed by neolocal residence. Tsimane' live in nuclear households and mostly practice monogamy.

In a survey done during 1996 among 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 centers on the sale of rice and forest goods and on work 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 started in 1999 and continues. Experienced interviewers and translators who had been part of the panel study from its start did the surveys in 2004. Elsewhere we describe the background of the study and discuss the methods used to collect information (Godoy et. al. 2005b; Godoy et. al. 2005c).

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. *The dependent variable: body-mass index*

In this paper we use a short-run anthropometric index, BMI, as a measure of child nutritional status and 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 increase 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. *The main explanatory variable: household bargaining power*

To develop a typology of household power structures we build on the common practice of asking spouses or parents about decision making in the household (Adato et al. 2000). 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.”

Participant responses to who decides on what food to buy or cook clue us into that person’s perception of decision making, but it may be that his or her spouse does not share that perception. For example, in some households, the mother and father may both answer that “I make the decision,” making it impossible to decide who actually makes the decision. This results in conflict over who actually makes the decision. In other households, both may say that their spouse makes the decision. To overcome the potential inaccuracy from responses based on self-perception, we match the response of a mother or a father with the response of their spouse. If we find that a participant’s self-perception of who decides meshes with the self-perception of the spouse, then 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 form our three dummy variables characterizing household power structure: *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.

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.

Our construction of who holds household bargaining power provides an accurate picture of who decides on decisions related to food acquisition and preparation in the home since each response is validated between spouses. 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, they decide what food to buy or what to cook. Therefore, we use instrumental variables to redress biases from the endogeneity of the three types of household power related to food acquisition and preparation.

C. Instrumental variables for household bargaining power

To identify instrumental variables for households in which the mother or the father decide about food acquisition and preparation or where both share in the decision, we first find variables closely linked to each type of household power. We estimate three equations: one for each type of household power and use all the covariates of BMI (as described in Section IV) plus the potential instrumental variables on the right side.

Potential instrumental variables include the level of inequality in well-being between mothers and fathers in the household. Here we explain the rationale for the use of the potential instruments. In development studies, researchers have focused on economic resources as determinants of bargaining power in the home (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. 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, use of z-scores as proxies of bargaining power was not found in the literature. We are motivated by Hindin (2000) who establishes an association between bargaining power and BMI. The difference 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 hold the power over household economic decisions. The same can be said for mothers. On the other hand, when there is economic and physical equality between mothers and fathers, power over decisions may be shared since each equally contribute to total household well-being.

Possible instrumental variables for the type of household power include: the difference in education, expenditure in the last 14 days, weight-for-age z-score, and height-for-age z-score between fathers and mothers of a household, and the mother's proportion of household assets, total household expenditure in the last 14 days and expenditure on durable goods in the last year. Columns a-c, Table 3, contain the results of the reduced-form regressions.

Next, 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 3.

The results in Table 3 suggest that some of our potential instruments are significantly associated with 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 between spouses 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's power over food acquisition and preparation at the 95% confidence level or 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's power at the 95% confidence level or greater.

The last three columns of Table 3 (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 3), 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* in a household, (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 in between mothers and fathers in xx, 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*.

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 in Table 4 (Wooldridge 2003; Baum, Schaffer and Stillman 2003) and find high p values, so we do not reject the overidentifying restrictions. Table 3 contains definitions and summary statistics of the dependent, explanatory, and instrumental variables used in the regression analysis.

VII. Results

The mean BMI of children in the sample is 16.90 (sd = 1.65) [girls = 16.80 (sd = 1.75); boys = 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 acquisition and preparation to those parents that do not, suggests that there is no statistical difference between the two groups of children ($t = 0.59$).

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 power over food decisions 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). The highly significant ($p=0.00$) result in 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/m² increase – a wisp of an effect on children's nutrition.

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 that mothers and

fathers that make joint decisions about what food to buy or cook have less inequality in BMI. We find no effect on girl's and boy's BMI from *mother power* and *father power* (columns e-1, Table 5).

VIII. Extensions of the analysis

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. 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. Because many studies suggest that income inequality might affect nutritional status, we condition for village income and wealth inequality using the CV and the Gini index of inequality. We removed the village dummies from the core model, and one-by-one, re-estimate equation 1 with different indices of each village inequality. The new coefficients for *shared power* are larger in magnitude (range from 4.0% to 4.2%) and increased 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 added 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 did not change our results.

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-estimated equation 1 with household size and the number of children. Our original impact of *shared power* on children's BMI is unaffected.

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

IX. Conclusion

In development, 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 in the home 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, children equally benefit. 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 is consistent with this view. 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 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.

Bargaining theory helps explain the outcomes found here. Vermeulan (2002) summarizes various models for collective - cooperative and non-cooperative - bargaining over household decisions. Some, e.g. Manser and Brown (1980) and McElroy and Horny (1981), suggest that households make decisions based on bargaining rules like the Nash solution. The Nash solution arises from a zero-sum game between parents to result in a Pareto optimal solution - where no further improvements in children's well-being can be made without making another child worse off. If true, then Tsimane' parents understand their spouse's preferences. So, a mother's preferences become an additional constraint on the father's decision making rules, and vice-versa. Consequently, decision making between Tsimane' parents becomes an interdependent process (bargaining) between spouses resulting in cooperation. Cooperation leads to equity concerns, since each party must take into consideration the other's preference. Furthermore, households in which mothers and fathers cooperate will be more likely to pool resources for greater household well-being. In this paper, we find that Tsimane' mothers and fathers that share power over food acquisition and preparation seem to act as one altruistic household head by equally contributing to girl's and boy's health. Vermeulan (2002) explains that this behavior can be characterized as a special case of collective household models that collapse into a traditional unitary model.

The fact that Tsimane households exhibit positive nutritional outcomes for children when parents share power is instructive for future quantitative household research. It may not be the case that individual power is best for total household well-being. An analysis of child health outcomes as a result of an exogenous income shock in Tsimane' households that share power will validate or refute our conclusions here. Also, repeated measurements of bargaining power and child health will help to elicit the effects over time. Finally, future studies that investigate the three household power structures as we have here, will help to understand bargaining patterns across societies. The possible policy implications are clear. Shifting resources into the hands of mothers may help to bridge the divide in household resources between parents, enhance her status, and give her control of household economic decisions, but it may come at the costs of conflict between parents and hurt some children as we see here.

X. Tables

Table 1:
Typology of household bargaining
power structures

Power Structure	Self Perception		Reality Check	
	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:
Summary statistics of variables used in regressions

Definition of variables:	N	Mean	Standard deviation
<i>Outcome variable</i>			
Log of child's BMI (body-mass index, kg/m ²)	516	2.82	0.09
<i>Explanatory variables</i>			
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
<i>Control variables</i>			
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 <u>boliviano</u> (\$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
<i>Potential instrumental variables</i>			
<i>Difference (see text):</i>			
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
<i>Female Proportion of (see text):</i>			
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 3:
Testing of adequacy of instrumental variables: Results of multinomial Logit and OLS regressions

Variables:	Dependent Variables:					
	Power Structure			Anthropometric Index		
	Shared	Female	Male	Log BMI	Log BMI	Log BMI
	[a]	[b]	[c]	[d]	[e]	[f]
<i>Power structure:</i>						
Shared	^	^	^	0.042 (0.018)**	^	^
Female	^	^	^	^	-0.022 (0.012)*	^
Male	^	^	^	^	^	-0.019 (0.014)
<i>Potential instrumental variables:</i>						
<i>Difference:</i>						
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)
<i>Female Proportion of :</i>						
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
Pseudo 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 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

Explanatory Variables:	Dependent Variables:					
	Log BMI		Log BMI		Log BMI	
	OLS	IV	OLS	IV	OLS	IV
	[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
<p>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.</p> <p>A - difference in parent's education and mother's proportion of household expenditure in last two weeks;</p> <p>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;</p> <p>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.</p>						

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

Explanatory Variables:	Dependent Variables:											
	Log BMI				Log BMI				Log BMI			
	OLS		IV		OLS		IV		OLS		IV	
	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.												

XI. List of References

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