Extended Families and Child Development: Evidence from Indonesia

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Abstract

This paper provides empirical evidence on whether and how resources controlled by extended family members affect child health and education using uniquely rich longitudinal data from the Indonesia Family Life Survey. IFLS contains information on resources under the control of each individual within households, and resources of individual family members who are not co-resident. By utilizing this information in the context of intrahousehold models, we provide direct empirical evidence on the role that intergenerational transfers play in human capital accumulation. Estimates are placed in the context of a theoretical model of family resource allocation that imposes few restrictions on preferences of individuals within a family. Our results suggest departures from the traditional unitary model of the family, but we cannot rule out that co-resident and non co-resident family members make allocation decisions cooperatively. The results are important for understanding family behavior and intergenerational exchanges.

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1 Introduction

How intergenerational transfers affect child well-being and human capital accumulation is poorly understood. Few data sets provide the information on resources under the control of both co-resident and non co-resident family members that is necessary to assess how extended families share resources. Even fewer data sets provide information that links the level and distribution of resources in the extended family to child outcomes. Using extremely rich longitudinal data from Indonesia, this paper provides empirical evidence on whether, and how, resources under the control of parents, grandparents, and other non co-resident family members contribute to child development. We present results in the context of a general model of family behavior, which provides a natural, but previously unused, setting to examine how human capital formation is influenced by intergenerational exchange and resource allocation.

The methodology of this paper is founded in models of family interaction. Many alternative models of individualistic behavior within households have been proposed in the literature.[1] Chiappori's (1988, 1992) collective rationality model offers the least restrictive approach in the intrahousehold literature, and relies primarily on the assumption that family members reach Pareto efficient outcomes in their allocation of resources. Although few papers have used this model to examine the extended family, it is an appealing approach, as it permits heterogeneous preferences across family members and generations, while placing plausible, testable restrictions on the nature of interactions between relatives.

Where other studies have been limited by the lack of data on the individual control of resources both in households and the extended family, we benefit from the use of a rich longitudinal panel. The Indonesia Family Life Survey (IFLS) is an ongoing panel survey that began in 1993, and currently contains data through 2007. IFLS has several unique features that we exploit in this paper, including its tracking of split-off households, detailed information on household and individual asset holdings, and numerous markers of health and well-being. The structure of the panel allows us to identify extended families in the data by following the method of Altonji et al. (1992), and linking split-off households back to their original root household. Once a dynasty is identified, we take advantage of detailed asset information at the household and individual levels to examine the impact of extended family members' resources on child development.[2]

[1] These will be discussed in the following section. See McElroy and Horney (1981), Chiappori (1988) and Lundberg and Pollak (1993) among many others.

[2] We will use "extended family" and "dynasty" interchangeably throughout the paper.

Examining extended family behavior through its impact on early life human capital accumulation has not been previously done in this form. There is no a priori reason to believe that extended families in developing country settings should be operating efficiently as described by Chiappori's collective model. One area where they may, however, is in the health and development of young children. Previous studies across the social sciences suggest that intergenerational transmission of resources plays a particularly important role in early life health and well-being, often as evidenced by complicated living arrangements consisting of multi and skip generation households throughout much of the world. The IFLS offers a rich set of outcomes to study, and we focus specifically on three markers of human capital; health, as captured by height, early school attendance, and cognition.

Since the collective model of the household is a more general formulation than the traditional unitary model of family behavior developed by Samuelson (1956) and Becker (1974, 1981), we follow the previous literature and begin by testing whether or not the restrictions of the unitary model are consistent with our data. Our results strongly reject the unitary model as the appropriate framework for the extended family. We then test the collective model, and are not able to rule out its predictions that extended families allocate resources in a Pareto efficient manner.

The remainder of the paper is organized as follows: section two places this work in the context of the relevant literature, section three presents a general theoretical framework, followed by a discussion of our empirical implementation in section four. Section five describes the data, section six presents results and discusses several robustness checks, and we conclude in section seven.

2 Background

This papers draws from the literature on intrahousehold models to analyze the extended family in the context of early life human capital accumulation. There is a growing body of work on the importance of the extended family in economic models and decision making, specifically in developing country settings where nuclear, two adult households are far less common than in the developed world.[3] Living arrangements in developing countries often consist of multi or skip generation households, and the extended family often fills the gap left by the absence of formal insurance markets and social safety nets.[4] For instance, work in

[3] For work and evidence on the role and importance of the extended family in the United States, see Cox (2003) and Bianchi et al. (2008) among many others.

[4] Perhaps the most well known interaction between extended family members is the exchange of remittances. The pattern of individuals abroad supporting a large group of their extended family that remains at home is common across the world.

India has shown that marriage markets are utilized as a means of insurance and consumption smoothing among rural families (Rosenzweig and Stark, 1989). The authors find that agricultural households are able to insure against drought and smooth consumption by marrying their daughters to men in regions that experience different weather patterns, and then exchanging transfers.

Another branch of the literature examines how interactions within extended families influence the effects of targeted transfer programs that have become increasingly common in developing countries. In South Africa, Bertrand et al. (2003) show that public pension programs targeted at the elderly affect the labor allocation decisions and health outcomes of individuals across the extended family. Similarly, Duflo (2003) and others find that the health of grandchildren whose grandparents receive pension income greatly improves following the transfer. The effect is largest for grandmothers and granddaughters, which suggests that the relationship is heterogeneous across gender, and endogenous dynasty living arrangements may allow at-risk children to benefit the most from pension income. Angelucci et al. (2010) use the Spanish naming convention and the randomized distribution of resources as part of the Progresa program in Mexico to show that extended family links play a key role in the outcomes and effectiveness of the program. The authors suggest that the observed increases in school enrollment are due in part to a redistribution of Progresa income within extended families from those who receive the transfer to their family members who are on the margin of enrolling their children.

In the context of Indonesia, where we focus, Thomas and Frankenberg (2007) show evidence of grandparent support of grandchild health during the Indonesian financial crisis.[5] Using data collected in the midst of the economic collapse, they find that while adult health worsened, the health status of children remained relatively stable during the crisis. The authors suggest that older adults "tightened their belts," to insure children against health insults related to the shock.

Where we differ from the aforementioned literature is our use of theoretical models developed in the intrahousehold literature to examine the extended family. With the large body of evidence on the importance of the extended family in decision making and human capital accumulation, we believe this is the natural setting to explore extended family interactions. The base model of analyzing the family in economics and social sciences is the traditional unitary model of Samuelson (1956). The model assumes

See Lucas and Stark (1985) for a theory of remittance exchange and empirical evidence from Botswana.

[5]After nearly three decades of sustained growth in Indonesia, 1998 saw GDP fall by 15 percent, rampant inflation of approximately 80 percent, political upheaval, public takeover of major banks, and the collapse of the rupiah - the exchange rate moving from 2,400 per USD to over 10,000.

that common preferences hold amongst family members, and households are best described as maximizing a single utility function subject to a single, pooled budget constraint. Becker (1974, 1981) later offered a variation of the unitary framework built around the notion of altruism within the family. In Becker's model, one "dictator" in the household serves as a social planner and allocates resources taking into account other family members' well-being.

The unitary framework persisted as the dominant model in economics until seminal papers rejected the notion that households could be modeled as a single decision maker. Early work by Manser and Brown (1980) and McElroy and Horney (1981) specified an alternative model of behavior where allocation decisions were the outcome of a Nash bargaining process between spouses. Others followed with alternative models, including those where decision makers operate in separate spheres of influence (Lundberg and Pollak, 1993). These early theoretical papers spawned a wealth of empirical work developing and executing empirical tests of the unitary model.[6] While early tests of the unitary model were mixed, the wealth of empirical evidence which has followed, including Schultz (1990), Thomas (1990), Lundberg et al. (1997), and Rubalcava and Thomas (2000) among others, has built strong support for the rejection of the unitary model as the appropriate framework for household analysis.

While models that introduced bargaining within the household were a welcomed break from the unitary framework, by imposing a specific type of bargaining process, they too restrict household behavior. With this as motivation, Chiappori and coauthors developed a more general model of the family which allows for heterogeneous preferences in the household while remaining agnostic on the actual decision making process.[7] Their model, referred to in the literature as the collective or collective rationality model, relies only on the assumption that allocation decisions achieve Pareto efficiency and are the result of a repeated game that can be approximated as achieving a cooperative equilibrium. This is an attractive framework to model extended families, as they often exhibit signs of altruism through living arrangements and transfers among members. Bourguigon et al. (2009) offers a recent and thorough characterization of the collective model, and shows that the tests of this model that we use are valid with all possible assumptions on the private or public nature of goods, all possible consumption externalities between household members, and all types of interdependent individual preferences.

This paper will develop a general model of extended family behavior that encompasses both the unitary

[6]McElroy (1990) focused on the empirical content of the bargaining model, and the earliest tests of the unitary model appeared in Horney and McElroy (1988).

[7]See Chiappori (1988), Chiappori (1992), Browning et al. (1994) and Browning and Chiappori (1998).

and collective models. There is a small collection of papers which have attempted this approach. Two examples are Dauphin and Fortin (2001) which offers a theoretical extension to the collective model with many decision makers, and Rangel (2004) which offers empirical evidence on Pareto efficiency within extended family agricultural households in Ghana.

In testing the unitary and collective models at the extended family level, we choose to focus on how resources impact child health and education outcomes. This is distinct from the vast majority of previous work which has focused on how the distribution of family resources impact consumption shares. Our use of outcomes with distinct human capital interpretations give our results clear welfare implications that other papers lack. While we discuss our particular outcomes more in depth in a later section, we note here that examining early life health as a marker of human capital is increasingly common in economics. Work in nutrition (Waterlow et al., 1977) has long supported the use of height as an indicator of well-being, and others have shown it to be predictive of a multitude of later life outcomes (Alderman et al., 2006).[8] Along with height, we also examine early school attendance, and a unique measure of general intelligence which we discuss in a later section, as our child outcomes.

We present a general model of extended family behavior and testable implications in the next section which grounds the empirical portion of the paper that follows.

3 Theoretical Framework

In specifying our model, we follow previous work by Chiappori and coauthors (e.g. Chiappori 1988, 1992, Browning et al. (1994)), and use similar notation to that in recent works by Rangel (2004) and Rubalcava et al. (2009). We consider the general welfare of an extended family to be a function of the individual utility of each of its members. Motivated by the literature on bargaining within households, we allow for an arbitrary bargaining process to occur between members of an extended family as they make allocation decisions.

To begin, let the welfare of an extended family, W, depend on the utility of each of its M members, where m=1,...,M. Each individual's utility, U_m, is allowed to depend on their own consumption and that of all other extended family members, each denoted by θ_{km}, $k = 1, ..., K$, where k indexes goods, and θ_{0m} denotes leisure of member m. The vector θ contains a variety of goods, but specifically includes health

[8] See Strauss and Thomas (1998, 2008) for a general review. See Almond (2006, 2007) and Meng and Qian (2006) for examples of papers which look at the ramifications or disease, famine, or conflict on those in utero and infancy.

and human capital outcomes. We analyze conditional demand functions related to human capital, and consider health and education directly as consumption goods. This is not an unreasonable assumption, as the aforementioned evidence suggests extended family members place great emphasis on the health and well-being of each other, especially their young children. We remain agnostic about the functional form that utility takes, and only require standard assumptions that it be quasi-concave, non-decreasing, and strictly increasing in at least one argument.

We allow individual utility to vary depending on individual, household, and dynasty specific characteristics. Some of these characteristics, denoted as μ, are observed in our data, and include variables such as age, household demographic structure, anthropometrics, and socioeconomic status. Other characteristics which influence utility, denoted by ε, remain unobserved to the econometrician. Such characteristics may include attitudes toward health investments and altruism. Each individual's utility function is thus defined as $U_m(\theta, \mu, \varepsilon)$.

The extended family welfare function, W, aggregates all of the members' utility functions with corresponding weights given by the function $\lambda(\pi, \xi)$. The weight an individual's utility receives within the extended family is allowed to depend on observed individual, household and dynasty characteristics, denoted π, which may include individual asset holdings, marriage market opportunities, age, prices, and the wealth of each dynasty member. The weights may also depend on unobserved characteristics, ξ, such as time preference.[9] The model is built to allow for decisions within the dynasty to be outcomes of bargaining amongst family members. The presence of the weighting function $\lambda(.)$ incorporates the notion of an intra-dynasty decision making process, and reflects each members' power in influencing allocation decisions. One advantage of this general model is that it allows for a variety of bargaining processes within the extended family. Thus, at this point we remain agnostic on the actual bargaining process within the dynasty, including whether or not one even occurs. As will be addressed further when discussing the collective model, the weights have no direct impact on an individual's utility, but do place restrictions on how an individual's power may affect decisions within the extended family.

As formulated, the dynasty's problem is to maximize extended family welfare subject to a budget constraint which requires the amount of dynasty expenditure to be less than or equal to the value of total family assets and labor income. Formally, the family solves the following problem:

[9] In this specification, π and ξ will generally include some factors which also influence preferences through μ and ε.

$$\max_{\theta} W[U_1(\theta, \mu, \varepsilon), ..., U_M(\theta, \mu, \varepsilon), \lambda(\pi, \xi)] \quad (1)$$

subject to:

$$p_\theta \theta \leq \sum_m [A_m + p_{0m}(T - \theta_{0m})] + A_0 \quad (2)$$

where A_m are assets controlled by family member m, and A_0 are assets jointly controlled by the dynasty. Individual labor income is the product of an individual's wage, p_{0m}, and labor hours, where T is the time endowment. Dynasty expenditure is equal to spending on consumption goods and human capital across all members, $p_\theta \theta$.[10] Although we present a static approach here, we recognize that there are potentially important implications of this model in a dynamic setting. Considering a dynamic model is left for future work, and will allow us to the speak to the literature on insurance and consumption smoothing within families in an important way.

The above framework is general enough to encompass both the unitary and collective models of extended family behavior that were discussed in the previous section. As these two frameworks provide the theoretical basis for the rest of the paper, we next present the conditional demand functions that stem from each of the models and discuss their testable implications.

3.1 Unitary Model

At the dynasty level, the unitary model is equivalent to either a model where all family members have the same preferences, or a dictator model where only one decision maker's preferences enter the welfare function W. If we impose the restrictions of the unitary model on our general framework, solving the extended family's maximization problem results in a conditional demand equation for good k of the form:

$$\theta_k = \theta_k(\sum_m y_m, p, \mu, \varepsilon) \quad (3)$$

where resources of member m, including assets and income, are given by y_m, p is a vector of exogenous prices, and μ and ε are observed and unobserved characteristics. The key feature of equation (3) is that individual resources enter the conditional demand equation only through their part in the *sum total* of

[10] Savings may be thought of as spending on an investment good.

family resources, $\sum_m y_m$. This is referred to in the literature as income pooling, and has proven to be a key testable implication of the unitary model. In the extended family setting, the restriction implies that once we control for total dynasty resources, the share under the control of a child's grandmother, father, aunt or uncle has no independent effect on allocation decisions.

Testable Implications of the Unitary Model

Since the extended family may be treated as a single decision making unit with pooled income in the unitary framework, the resource distribution within the family is irrelevant. We can test this prediction by examining the marginal effect of each member's resources. Since only the sum total matters and not the distribution of resources, the unitary model predicts that the marginal effect of each members' resources should be the same regardless of which individual or individuals we consider. Letting family members be indexed as m and n, we can write this in terms of equation (3) as:

$$\frac{\partial \theta_k}{\partial y_m} = \frac{\partial \theta_k}{\partial y_n} \quad \forall k, m, n \tag{4}$$

While this test has been undertaken in a variety of papers empirically assessing the validity of the unitary framework, we choose to use an alternative specification.[11] Since only total dynasty resources matter in the conditional demand function in (3), if we condition on total family resources, $\sum y_m$, the share controlled by any individual should have no impact on θ. In terms of equation (3), that is:

$$\frac{\partial \theta_k}{\partial y_n}|_{\sum y_m} = 0 \quad \forall k, n \tag{5}$$

A full description of our empirical specification for this test, its advantages, and a discussion of results follow in the later sections. We turn next to the collective model, and discuss the testable implications that follow from a more general framework of family behavior.

3.2 Collective Model

If we reject the unitary framework, the aforementioned tests do not say what an appropriate alternative model of family behavior should be. It is only natural then to follow tests of the unitary model with those derived from a more general alternative. The collective model relaxes the common preferences or dictator assumptions of the unitary framework, and instead relies only on the assumption that allocation decisions

[11] See Horney and McElroy (1988), Schultz (1990), and Thomas (1990) among others for tests of the unitary model.

achieve Pareto efficient outcomes.[12]

Income Sharing Approach

The collective model is formally equivalent to a two-stage budgeting model as shown by Browning and Chiappori (1998). In the first stage, the extended family pools their resources together and then divides them amongst family members, with each member receiving a share determined by their relative power within the dynasty. In the subsequent second stage, members make maximizing allocation decisions subject to the resources that they received in the first stage.

The share a decision maker receives is determined by a sharing rule, which is modeled through the function $\alpha(.)$ and related to the weighting function defined earlier, $\lambda(.)$. The sharing function depends on individual resources, prices, and other observed and unobserved factors, and can be written as $\alpha(y_1, ..., y_M, p, \pi, \xi)$. Letting Y^* be total pooled dynasty resources, each member m receives a fraction of total resources Y_m as determined by the sharing rule:[13]

$$Y_m = \alpha_m(y_1, ..., y_M, p, \pi, \xi)Y^*$$

The collective model allows more influential family members to have a greater say in the relative share each individual receives. In the second stage, members then maximize their own utility subject to a budget constraint that limits allocation decisions by Y_m. The resulting conditional demand equation for good θ_k takes the form given below:

$$\theta_{mk} = \theta_{mk}(Y_m(y_1, ..., y_M, \pi, \xi), p, \mu, \varepsilon) \tag{6}$$

Equivalently since each Y_m depends on the sharing rule:

$$\theta_k = \theta_k(y_1, ..., y_M, p, \mu, \varepsilon) \tag{7}$$

In contrast to the conditional demand equation for the unitary model shown in (3), this function has very different properties. Where only the total amount of resources mattered in the demand function derived from the unitary model, here each members' resources now enter individually through each Y_m. This leads to a testable implication well established in the intrahousehold literature as shown and used in

[12] An additional additive separability assumption is also needed which we discuss later.

[13] Y^* is thus equivalent to $\sum_m y_m$ from our characterization of the unitary framework.

Chiappori (1992), Bourguigon et al. (1993), and Browning and Chiappori (1998) among others.

This test follows from the way individual resources only influence demand through the share of resources an individual receives in the first stage, Y_m. Chiappori and coauthors show that under the assumption of Pareto efficiently, this implies that the ratio of marginal effects of one family member's resources on good θ_k to another member's resources will be constant across goods. Intuitively, this comes from the specification of equation (6), and an assumption of weak separability between factors which influence bargaining power and others that influence demands. Any factor, such as y_m, that affects the demand for θ_k only through the share of resources received in the first stage, must affect all demands from the second stage in the same way.

Testable Implications of the Collective Model

This test of Pareto efficiency can be carried out by looking at the ratio of marginal propensities to consume with respect to different members' resources. Consider a demand equation of the form defined in equation (6) and $M = 2$ for ease of notation and clarity, although the implication holds for an arbitrary M as shown in Bourguignon et al. (2009). The model predicts that the ratio of marginal propensities to consume from y_1 to y_2 will be constant across goods. First, the marginal impact of y_1 on a good θ is :

$$\frac{\partial\theta}{\partial y_1} = \frac{\partial\theta}{\partial Y^*}\frac{\partial Y^*}{\partial y_1} \tag{8}$$

Similarly, the marginal impact of y_2 on the same good θ is:

$$\frac{\partial\theta}{\partial y_2} = \frac{\partial\theta}{\partial Y^*}\frac{\partial Y^*}{\partial y_2} \tag{9}$$

Note that in both derivatives, the first term is independent of y, while the second term is independent of θ. This is a direct result of each y only influencing demand for θ through the share of resources received in the first stage.

If we take the *ratio* of marginal effects, equation (8) divided by equation (9), the first term in each derivative will cancel, and the resulting expression is independent of θ.

$$\frac{\frac{\partial\theta}{\partial y_1}}{\frac{\partial\theta}{\partial y_2}} = \frac{\frac{\partial\theta}{\partial Y^*}\frac{\partial Y^*}{\partial y_1}}{\frac{\partial\theta}{\partial Y^*}\frac{\partial Y^*}{\partial y_2}} = \frac{\frac{\partial Y^*}{\partial y_1}}{\frac{\partial Y^*}{\partial y_2}} \tag{10}$$

We utilize this result to empirically assess the predictions of the collective model. Written more generally for arbitrary goods j and k, and resources in control of m and n, a system of demand allocations is compatible with Pareto efficiency if the ratio of marginal effects is constant across outcomes. That is:

$$\frac{\frac{\partial \theta_j}{\partial y_m}}{\frac{\partial \theta_j}{\partial y_n}} = \frac{\frac{\partial \theta_k}{\partial y_m}}{\frac{\partial \theta_k}{\partial y_n}} \quad \forall\, j, k, m, n \tag{11}$$

This restriction is a direct result of the two stage budgeting process. Since the distribution of dynasty resources takes place before individual allocation decisions, factors which influence the share can only affect allocations in a specific way in the second stage. With a conceptual model at hand, we move next to discuss our empirical implementation, data and results.

4 Empirical Implementation

This section will place the previously derived theoretical results in an empirical regression context. The unitary model predicts that the distribution of resources within the extended family should have no effect on allocation decisions. To test this prediction, we asses whether or not the share of total dynasty resources controlled by a child's household is a significant predictor of human capital outcomes. If the unitary model is rejected, we can then test the collective model by looking at the ratio of resource effects across different outcomes. We undertake the unitary test only at the household level, but the Pareto efficiency tests at the household and individual levels.

4.1 Unitary Model

To analyze the extended family in a unitary framework, we estimate the following linearized version of the conditional demand function presented in equation (3):

$$\theta_{mhd} = \beta_1 y_h + X_{mh}\gamma + \eta_d + \varepsilon_{mhd} \tag{12}$$

where θ_{mhd} is the outcome of child m in household h and dynasty d, y_h are household resources, and X_{mh} are relevant control variables at the child and household level. The dynasty fixed effect, η_d, captures all characteristics common at the dynasty level that are additive and linear. The use of a fixed effect specification exploits our genealogical construction of extended families which we discuss in the following section. It allows us to control for forms of otherwise unobserved heterogeneity that may be difficult to model. These include, but are not limited to, common genetic background, dynasty wide preferences, heredity factors, common prices, and expected future family resources.

The coefficient of interest in equation (12) is β_1. The unitary model predicts that, conditional on total dynasty resources, the share controlled by a child's household should have no impact on θ. Since total dynasty resources are captured through the fixed effect, η_d, the null of our test is:

$$H_0 : \beta_1 = 0 \tag{13}$$

Thus, if the estimated β_1 is statistically different from zero, we are able to reject the unitary model.

4.2 Collective Model

Since the collective model is a more general version of family behavior than the unitary model, it is natural to follow rejections of the unitary framework with tests of Pareto efficiency. To do this, we estimate a linearized version of conditional demand function define in equation (7):

$$\theta_{mhd} = \beta_1 y_h + \beta_2 y_d + X_{mhd}\gamma + \varepsilon_{mhd} \tag{14}$$

where y_d are the resources of all other households in the dynasty excluding a child's own household h. In order to estimate the marginal impact of resources directly controlled by other family members outside of a child's household on θ, we must remove the dynasty fixed effect from (12) and estimate the linear analog instead to obtain an estimate of β_2. We then include dynasty characteristics along with child and household controls in X_{mhd} to isolate the effect of resources in y_h and y_d.

As previously shown, the collective model imposes restrictions on the ratio of coefficients across outcomes. Letting β^j and β^k represent the marginal impact of resources on outcome j and k, the null of the collective rationality test is

$$H_0 : \frac{\beta_1^j}{\beta_2^j} = \frac{\beta_1^k}{\beta_2^k} \quad \forall\, j, k \tag{15}$$

That is, the ratio of marginal effects must be constant across outcomes.

When we test the collective model at the individual level, we modify equation (14) to include resources under the control of a child's mother, father, grandfather, and grandmother and include relevant controls for each individual. The conditional demand function we estimate is given by the following equation:

$$\theta = \beta_1 y_{father} + \beta_2 y_{mother} + \beta_3 y_{grandfather} + \beta_4 y_{grandmother} + X\gamma + \varepsilon \tag{16}$$

where X now includes controls for child, household, maternal, paternal, and grandparent characteristics. The same ratio test used at the household level applies to the individual model for each of the possible ratios. The null is simply a more general version of the previous form, which must hold across all four β coefficients rather than only two.

$$H_0 : \frac{\beta_m^j}{\beta_n^j} = \frac{\beta_m^k}{\beta_n^k} \quad \forall\, j, k, m, n \tag{17}$$

4.3 Estimation

Since the collective model imposes cross equation restrictions, we estimate the three equations jointly in order to obtain the variance covariance matrix necessary to construct the nonlinear Wald statistics for the Pareto efficiency test. We do this by estimating the equations in a seemingly unrelated regression (SUR) framework. We also allow for intra-family correlation in our errors, and cluster all standard errors at the family level. Since we compare health outcomes across children in the same family who clearly share genetic components, this is a potential source of confounding correlation that must be accounted for.

5 Data

Our data come from the fourth wave of the Indonesia Family Life Survey (IFLS). The IFLS is a large-scale, ongoing longitudinal survey that began in 1993 and recently released data from the fourth wave collected in late 2007 and early 2008. The IFLS began with a sample of 7,224 households and 22,000 individuals from 13 of Indonesia's then 26 provinces that was representative of 83 percent of the population. The second wave was collected in 1997, and a third in 2000. The most recent wave in 2007/2008 includes 13,500 households and 43,500 individual interviews.[14] One of the exceptional features of the data set is the high re-contact rate, including among those who relocate.[15] The IFLS4 team successfully re-contacted

[14]For a full description of IFLS1, IFLS2, IFLS3 and IFLS4, respectively see Frankenberg and Karoly (1995), Frankenberg and Thomas (2000), Strauss et al. (2004), and Strauss et al. (2009).

[15]IFLS tracks all movers if they relocate to one of the 13 IFLS provinces.

90.6% of the living IFLS1, 2 and 3 households, and 87% of original living IFLS1 respondents. These rates are as high, or higher, than most longitudinal surveys in the United States and Europe.

Constructing the Extended Family

We follow a similar method to that used by Altonji et al. (1992) in linking households to their extended families. Similar to the Panel Study of Income Dynamics data in the US, which Altonji et al. (1992) used, the structure of the IFLS panel allows us to identify dynasties using family members who have left IFLS households and been followed by the survey. Starting from a base household, when a member leaves to form a new household, often through marriage, the newly formed unit is located and becomes part of the IFLS in all subsequent waves. We thereby create IFLS dynasties by linking these split-off households back to their original root. Although we do not observe the full genealogical family tree, it is a rich characterization of the extended family. One advantage of linking the data in this way is it allows us to empirically sweep out unobserved heterogeneity at the extended family level through the use of dynasty fixed effects in our tests of the unitary model. Table 1 provides an overview of the number of children, households, dynasties, parents and grandparents in our sample.

Health and Development Outcomes

We look at three markers of child health and development in our estimation; height-for-age, early school attendance, and cognition.[16] We convert height to age and gender specific z-scores using the 2000 Center for Diseases Control growth tables, which uses a representative, well-nourished child in the United States as the norm. As mentioned earlier, height is an accepted long-run marker of human capital, and a stock variable embodying nutritional investments made during early childhood.[17] While a variety of nutrition and medical studies have found the heredity of height to be approximately 75 to 80 percent (e.g. Silventoinen et al., 2000), the remaining 20 - 25 percent is a reflection of environmental factors during pregnancy and early life, including maternal smoking, nutritional intake, the disease environment, and health insults. The effect of resources on height have been shown to be most influential in the early years of life (Alderman et al., 2006), so when considering height-for-age, we present results for children from six month to age four separately from those children age five to age nine.

We also examine early school attendance as a dependent variable and marker of human capital accu-

[16]The IFLS contains a wide range of potential outcomes, and we have also considered BMI, weight-for-age, an interviewer's health assessment, school enrollment, and others. Results using outcomes besides those presented here are consistent with those shown and available upon request.

[17]See, for example, Alderman et al. (2006), Strauss and Thomas (1998), Mwabu (2008) and Waterlow et al. (1977).

mulation. Although in a different context, work examining the causal effect of early start programs in the United States show a significant positive effect of early school attendance on markers such as high school completion, college attendance, and later life outcomes (e.g. Garces et al., 2002). We simply follow the chain of reasoning that attending school at an early age will offer those students an advantage in later life. In particular, we use whether or not a child ever attended kindergarten in a sample of children age six to fourteen.[18]

Finally, we take advantage of a unique and underutilized module in the IFLS which measures cognition through a non-verbal assessment. Individuals age seven to fourteen were given a test comprised of twelve Raven's Colored Progressive Matrices (CPM) questions and five math problems to assess their cognitive function.[19,20] Since the CPM is an metric not often used in the economics literature, we have included a sample question as Figure 1.

The CPM assessment is commonly used in medicine and psychology as a measure of general intelligence, and is accepted as the single best measure of Spearman's general intelligence factor g (Kaplan and Saccuzzo, 1997). The presence of an accepted objective measure of cognition is one of the great benefits of IFLS. Since the CPM test is based on pattern recognition, there is a natural positive correlation with age among the children respondents from age seven to fourteen. We considered standardizing the scores by age, but instead choose to use the percent correct as the dependent variable, and control for age in a flexible way in our regressions. The results are not sensitive to this specification.

Distribution Factors

To test the theoretical predictions of the two models, we need a measure of relative power that influences the bargaining process within a family. In our estimation, we associate power with the value of assets under the control of each household, or individual, within a dynasty. The IFLS includes a detailed roster of assets broken into thirteen categories.[21] We consider all household assets excluding housing and land to be considered liquid, and focus on those in our estimation.

One of the benefits of focusing on assets is the ability to conduct our analysis at both the household and individual level. The IFLS is unique among major surveys in its inclusion of questions about individual

[18] This is an indicator equal to one if a child is currently enrolled in kindergarten or ever was.

[19] A similar, but longer, test was given to individuals between the ages of fifteen and twenty four.

[20] The CPM is designed particularly for children. For a background on the Raven's Standard Progressive Matrices (SPM) test, see Raven (1958), or for a more recent treatment, see Raven (2000).

[21] In the order asked, they are: house occupied by the household, other house, non-agricultural land, poultry, livestock, hard stem plant, vehicles (cars, boats, bicycles and motorbikes), household appliances, savings/certificate of deposit/stocks, receivables, jewelry, household furniture and utensils, and other.

resources within a household. The questionnaire asks each adult member of a household age 15 and above about the total value of household assets in each of the thirteen categories, and the share which they and others within and outside the household control. We obtain our measures of individual resources by multiplying the reported value of an asset by an individual's share, and then sum over the liquid asset categories. Since we often have different and inconsistent answers for individuals within the same household, there are plausibly many models for constructing individual assets. One possibility would be to trust the household head's response as the correct depiction of the asset distribution, and create individual assets from their response on others' ownership. Instead, we choose to use each individual's own response if available.[22] We chose this method after observing that spouses systematically underreport the value of assets held by their partner. This pattern is particularly true for husbands' reports on their wives' assets.

While we begin with household level analysis as a firsts step and to be consistent with the literature, utilizing individual level data has many advantages. Chief among these is the ability to avoid concerns associated with endogenous living arrangements that plague analysis at the household level. Using individual level data allows us to compare resources of different family members both within and across households. This lets us examine any sharing and insurance that happens between extended family members, but within a household unit. For instance, if the primary means of sharing and consumption smoothing amongst families happens through co-residence patterns, ie. grandmothers living with young children, this will be missed using household level data, but visible at the individual level.

However, focusing on assets is certainly not without risk, and our results come with the caveat that assets themselves may be the outcomes of an extended family allocation process and pose endogeneity concerns. However, they do serve a distinct improvement over the common practice of utilizing expenditure, and allow us to look at the results and tests at the individual level. To be consistent with the literature, we have done tests of the unitary and collective models with household per capita expenditure instead of assets and include a discussion of the results in Appendix A. We maintain a preference for assets, as they reflect a closer, although still imperfect, representation of long-run resources, which is what our testable implications are founded upon. Without additional restrictive assumptions, expenditure should be seen as the outcome of the bargaining process, not a distribution factor which influences the first stage of the budgeting process.

We include a variety of control variables on the right hand side to isolate the resource effects in our

[22]If an individual's own response is not available due to refusal or other reason, we use the response from a spouse.

asset measures. At the child level, we include gender and age, using indicator variables for each age. This is a flexible way to capture any significant differences between older and younger children in the measures of health and human capital, including those mentioned with the cognitive score. We also condition on whether the child lives with their mother and father, since it is likely that those children who co-reside with their parents experience different environments and familial interactions that those that do not.

At the household, and dynasty level when appropriate, we include demographic controls including household size and composition variables. For composition, we include the number of household members divided into five distinct groups: children, prime age males, prime age females, senior males, and senior females.[23] In regressions which look at the household and dynasty level, we control for age and education of the household and dynasty head, and for regressions at the individual level, we include the age and education of both parents and grandparents. We code education as the highest level completed rather than years, although the results are not sensitive to this specification.[24] We also control for location with province indicators, and include an indicator for whether the household is located in an urban or rural region to account for the fact that resources are systematically higher in urban areas.

Finally, to control for the genetic component of height, we include both mother's and father's height. Since adult height is correlated with labor market outcomes, this also controls for labor market factors not captured by parental education. Summary statistics reporting means and standard errors are shown in Table 2. Because we consider different samples due to the relevance of our outcomes for different age groups, we present both summary statistics for all children from birth to 14 in column one, and for each of the four groups in columns two through five. Looking at our outcomes of interest, we see that height for age in young children has a mean of -1.2 and -1.5 in older children, implying that children in Indonesia are more than one standard deviation shorter than well-nourished children of the same age and gender in the United States. We also see that approximately half of the children between 6 and 14 currently attend or attended kindergarten, and the mean score on the cognitive assessment is seventy one percent correct.

Liquid assets are reported in 10,000 rupiah, which is approximately 1 USD. Dynasty assets are defined as total assets of the extended family less an individual's specific household assets. Table 2 shows that the majority of extended family resources are controlled by those outside a given child's household, with

[23]We define prime age as 15-55 and senior as 56 and above. Results are not sensitive to these cut-offs. Since we include household size in our regressions, we have to exclude one category to avoid multicollinearity - we choose senior women.

[24]We include education through dummies for each of the following levels: no education, kindergarten, elementary, junior high, senior high, and greater than senior high.

a given household owning approximately 40 percent of total dynasty resources. We also see that the value of assets controlled by fathers is more than mothers, as is grandfathers compared with grandmothers.

With a theoretical model at hand, and a knowledge of the data and empirical specification, we move next to discuss our results.

6 Findings

In this section, we present and discuss our empirical results in the context of the unitary and collective models. Throughout, we refer to tables 3 through 7, which report β estimates.[25] For analysis at the household level, we use a logarithmic transformation of asset levels. However, for analysis at the individual level, there are multiple reports of zero asset holdings. To address this problem, we use a quartic root transformation, which approximates the common logarithmic transformation but is defined at zero while the log is not. This has the advantage of not dropping observations as the result of the log transformation. We maintain logs at the household level for ease of interpretation, and because there are not a significant amount of zero-valued observations to warrant concern.[26] In the tables that show regression results, column one for each outcome shows the combined effect for both boys and girls, while column two includes results from a similar model, but one that is fully interacted with gender to allow for varying effects amongst boys and girls. This allows us to assess the predictions of the unitary and collective models differently for each gender. The relevant coefficient, and ratio where applicable, for boys is reported on the same line as the main effect, and the relevant coefficient for girls is the sum of the main and interaction effects.

6.1 Tests of the Unitary Model

To begin, Table 3 shows results for tests of the unitary model from equation (12) using dynasty fixed effects to sweep out factors that are common, additive and linear at the dynasty level. Since we use a logarithmic transformation, the coefficients may be interpreted in the usual approximation of percentage changes. However, the main interpretation and inference relies only on the sign and significance regardless of the transformation; when the value of resources controlled by a child's own household increases, we see a

[25]Due to space and clarity considerations, only the β coefficients are reported here. Results including all controls are available upon request.

[26]99.2% of all households report non-zero values for liquid asset holdings. The remaining 0.8% are not dropped, but instead we replace the 0 value with the mean and include an indicator in the regression noting replacement.

significant increases in all three of our health and human capital outcomes. In terms of gender differentials, we do not see any significant differences between boys and girls.[27]

These results reject the restrictions of the unitary model, which predicts that all of the reported coefficients in Table 3 be zero. We reject the notion that the share of resources controlled by an individual household have no impact on child outcomes once we condition on total dynasty resources. This suggests that the unitary model is not an appropriate representation of the extended family. This does not come as a surprise, and is a consistent finding in the intrahousehold literature. However, since the collective model subsumes the unitary, establishing a rejection of the unitary model is a natural first step before testing the more general implications of Pareto efficiency.

6.2 Tests of the Collective Model

Household Pareto Efficiency Regressions

In order to test Pareto efficiency between households and the remainder of the extended family, it is necessary to remove the dynasty fixed effect from the previous model, and estimate equation (14) instead. Doing so allows us to estimate the marginal effect of resources controlled by non co-resident family members outside of a child's own household. These results are shown in Table 4, which reports estimates that are similar to the fixed effects specification for household resources. More importantly, it provides evidence that extended family resources *do* have an impact on human capital accumulation of young children. This is seen most clearly in early school attendance and cognitive scores, where increasing the value of assets held by non co-resident family members increases enrollment and cognitive achievement. Dynasty resources are also also positive and significant in regressions examining height-for-age, albeit only at 10 percent. This is evidence of inter-dynasty transfers, and may be similar to the pattern shown in Mexico by Angelucci et al. (2010). The coefficients for the other outcomes are positive yet imprecisely estimated. The ratios reported in the lower panel of Table 4 are obtained using the delta method, and show that the effects of household resources are relatively larger than those of dynasty resources.

Household Pareto Efficiency Tests

Table 5 shows the results of the cross equation, nonlinear Wald tests of Pareto efficiency described in (15). When we execute these tests, we combine our two height-for-age samples into one sample of children

[27]The one exception is with older children's height-for-age. Investigation into any differential biology of growth for Indonesian boys and girls not accounted for in the standardization of the z-scores did not lend any support to a substantial difference.

six months to age nine. The coefficient estimates for the two different age groups are not statistically different from each other, and combining also allows for greater precision in our ratio tests. The three ratios that we use are reported in panel A of Table 5, and p-values from the nonlinear Wald tests appear in panel B. The first three rows of panel B show pairwise test of the restrictions for the outcome in the first column and the second column. Although the model implies the restrictions hold across all three outcomes, we report these pairwise tests of efficiency so as to not miss any possible rejections on a case-by-case basis in addition to the overarching test. For example, the first value in Panel B of 0.50 suggests that we cannot reject that the ratio of household to dynasty resources is the same for height-for-age and early school attendance. The final row shows the test for equality across all three ratios.

We include the second and third columns in panel B of Table 5 to examine potential gender differences in efficient allocation. Our results suggest that we are not able to rule out Pareto efficiency in any of the tests, including those differentiating by gender. All of the p-values are well above any reasonable range of rejection. Thus, while we are able to reject the unitary model of the extended family, we are not able to reject that extended families allocate resources Pareto efficiently, and may be appropriately modeled as a collective unit.[28] All of the ratios are statistically indistinguishable and in the range of 2.52 to 4.01. Economically, this implies that the marginal impact of a child's own household resources is approximately two to four times larger than resources controlled by other dynasty members.

Individual Pareto Efficiency Regressions

Having rejected the unitary mode but not tests of collective rationality at the household level, we next look within the extended family at the individual level. These results provide empirical evidence on the importance of intergenerational transfers in child development. As mentioned earlier, that we provide individual level results for members within an extended family is a unique feature of our data and paper. Although there is a slightly more nuanced interpretation due to the quartic root specification, the main implications and interpretation based on sign and significance is still valid. Our findings, shown in Table 6, suggest that children significantly benefit from resources controlled by their mothers. We see this specifically in height-for-age and cognitive scores. Since these are both markers of long-run human capital, this finding suggests persistent benefits for those children in families where mothers control a substantial amount of resources. The result that children benefit as their mothers gain is consistent with previous

[28]It is important to note that although we find no evidence of differences between girls and boys in terms of efficiency, this does not rule out different behavior or patterns of allocation, only that the outcomes for both boys and girls can be characterized by an efficient allocation process.

findings examining the allocation of resources toward women and children (e.g. Thomas, 1990; Duflo, 2003).

While the result concerning mother's resources is the same for kindergarten attendance, a more revealing pattern exists with early school attendance. Mother's assets show a large, positive and significant effect, but there are also positive and significant effects for father's and grandmother's assets. This may be related to time use, in that wealthier dynasties may not need their children to work in home production and can send them to school instead. More importantly, it shows specific signs of intergenerational interaction, as the effect of grandmothers' assets is on the order of fathers' resources. Father's assets are also significant in early height-for-age.

Individual Pareto Efficiency Tests

The final table of our results, Table 7, shows the individual level analog to the household Pareto efficiency tests in Table 5. Again, the table shows p-values from the nonlinear Wald test of the restrictions imposed by the collective model. Since we look at four different resource coefficients (resources controlled by mothers, fathers, grandmothers, and grandfathers), there are six pairwise ratios to test, as well as equality across all six for each pair of outcomes, and equality of all six ratios across all three outcomes. In Table 7 the individual listed in the column is the denominator and the individual in the row is the numerator. For example, 0.37 is the p-value of the test comparing the marginal impact of father's resources to mother's resources between height-for-age and early school attendance. The value suggests that we cannot reject the null with any reasonable confidence level. Panels B and C report p-values for tests on boys and girls separately, but we find no differences in the interpretation of the model. There is only one test where we reject Pareto efficiency at the 5 percent confidence level, for mother and grandfather assets comparing kindergarten attendance and cognitive scores in the tests which combine boys and girls. However, this is only one rejection out of 66 tests in table 7 and is not rejected in either of the gender specific tests. In all others cases, we cannot rule out that extended families behave in a Pareto efficient manner.

6.3 Robustness Checks

Our rejections of the unitary model and failure to reject Pareto efficiency are robust to a variety of different outcomes, empirical specifications and sample stratifications. We have already presented results which test Pareto efficiency separately for boys and girls, and saw no difference in our results. The same holds true for examining other health and education outcomes in the IFLS including BMI, weight-for-age, an interviewer's health assessment, school enrollment and others. This section briefly discusses additional specification checks and sensitivity analysis which we completed.[29]

To start, the regressions in equations (12) and (14) that we use to estimate the unitary and collective models are linear in the log or quartic root of assets. We also examined a variety of specifications for our empirical tests that allowed assets to enter in non-linear forms including quadratic and cubic polynomials and splines. Neither rejections of the unitary model nor failures to reject Pareto efficiency were sensitive to these alternative specifications, and we were not able to rule out linearity through the use of specification tests. We also attempted to address the incomplete nature of our constructed extended families. Because we base dynasties on a collection of split-off households, our sample does not include any children who are in the extended family but outside of IFLS households. To assess whether it matters if the root household is on the maternal or paternal side of the dynasty, we separately estimated models for families where the mother in a new household is an IFLS panel member compared with those where the father is an IFLS split-off. Again, we found no significant differences.

To test whether Pareto efficiency could be rejected for different sub-groups of the population, we stratified out sample on a variety of demographic factors. This allowed us to examine if Pareto efficiency would be rejected for families with different demographic composition, education levels, or greater physical distance between members.[30] We stratified the sample based on the number of household and dynasty members, the number of children within a household or dynasty, and the number of other children within the household or dynasty within 3 years of a child's age to assess whether competing over resources has any impact on efficiency. We also examined whether stratifying the sample based on urban and rural households, geographic distance to other family members, the age of a child's mother and father, and the mean and maximum levels of education among adults in the family had any impact on our results. Across all stratifications, we found no rejections of Pareto efficiency.

All of the results presented here use data from the 2007 wave of the IFLS. We have also made use of the IFLS panel to verify our current results.[31] Reestimating the models using data from the 2000 wave of

[29]To conserve space, results discussed in this section are omitted from the paper, but they are available from the authors upon request. They will also be available online at `www.econ.duke.edu/ drl13/extendedfamilies`

[30]It may be more difficult for extended family members that are not located near each other to exchange transfers, for example.

[31]There are some challenges using the full panel in our research design. Because families expand over the course of the survey, the number of dynasties with split-off households is much smaller in earlier waves of the survey. This makes it difficult to estimate models that rely on variation at the dynasty level. However, the 1997 and 2000 wavs of the survey do have lower levels of attrition, which makes analyzing them attractive. The IFLS2 in 1997 and the IFLS3 in 2000 recontacted 95 percent of living IFLS1 households, while IFLS4 recontacted 91 percent.

the IFLS provides a verification that our results are not specific to the one wave we choose to use. The estimation results from 2000 are consistent with those shown here. We again reject the unitary model and fail to reject Pareto efficiency. Moreover, the coefficient estimates are also remarkably similar across waves.

We also considered combining data across waves to form a panel. This would allow us to estimate models which control for dynasty fixed effects in all regressions, not only those testing the unitary model. Combining the 2000 and 2007 samples, for instance, would mean that we had data where dynasty assets vary across time. However, the sample of individuals for which these models is identified is small and selected. Consider the model which estimates the impact of household and dynasty resources on cognitive scores, shown in equation (14), as an example.[32] The cognitive score outcome is defined for children age 7-14. In order to identify the effect of dynasty resources independent of a dynasty fixed effect, we would require there to be multiple children in the extended family between 7 and 14 in both the 2000 and 2007 waves of the survey. Furthermore, the children would have to be in different households within the extend family. This is a small and selected subset of the children in our sample.

We do not believe our results are unreasonable. A wealth of literature supports the importance of the extended family in human capital accumulation, and many papers have shown allocations to be Pareto efficient at the household level.[33] Our analysis has extended these results to the extended family which plays an important role in child development. We summarize and offer ideas for future work to strengthen our results as we conclude.

7 Conclusion

Transfers between extended family members are thought to be an important part of the lives of many individuals, yet there is little known empirically on the subject. This paper offers an improved way to specifically understand the role that interactions between extended family members play in child development. Through the use of general models of family behavior, we show that the unitary model is not a valid characterization of the relationship between co-resident and non co-resident family members. However, we are not able to rule out that allocation decisions achieve Pareto efficiency. This is true at the household level, and the unique nature of the IFLS allows us to show that it is true at the individual level

[32] The proposed estimation equation would then be $\theta_{mhd} = \beta_1 y_h + \beta_2 y_d + X_{mhd}\gamma + \nu_d + \varepsilon_{mhd}$ where ν_d captures time-invariant observed and unobserved heterogeneity at the dynasty level.

[33] See, among others, Bourguigon et al. (1993).

as well. These results highlight the role and importance of the extended family in early life human capital accumulation.

Using our framework to look at adult health outcomes may offer an interesting complement to these results. If extended families focus on child but not adult health, this may be an area where Pareto efficiency among families is actually rejected. We will examine this possibility in future work. The results presented here are important for understanding intra-family relationships and generational exchange. We show that even in a setting where market imperfections are often thought to disrupt exchange, extended families are able to allocate resources efficiently to aid in the health and development of their youngest generation.

References

Alderman, H., J. Hoddinott, and B. Kinsey, "Long Term Consequences of Early Childhood Malnutrition," *Oxford Economic Papers*, 2006, *58*, 450–474.

Almond, D., "Is the 1918 Influenza Pandemic Over?," *Journal of Political Economy*, 2006, *144*, 672–712.

_ , L. Edlund, H. Li, and J. Zhang, "Long-term Effects of the 1959-1961 China Famine: Mainland China and Hong Kong," 2007. Mimeo.

Altonji, J., F. Hayashi, and L. Kotlikoff, "Is the Extended Family Altruistically Linked? Direct Tests Using Micro Data," *The American Economic Review*, 1992, *82* (5), 1177–1198.

Angelucci, M., G. DeGiorgi, M. Rangel, and I. Rasul, "Family Networks and School Enrolment: Evidence from a Randomized Social Experiment," *Journal of Public Economics*, May 2010, *Forthcoming.*

Becker, G., "A Theory of Social Interactions," *The Journal of Political Economy*, November 1974, *82* (6), 1063–1093.

_ , *A Treatise on the Family*, Cambridge, Massachusetts: Harvard University Press, 1981.

Bertrand, M., S. Mullainathan, and D. Miller, "Public Policy and Extended Families: Evidence from Pensions in South Africa," *The World Bank Economic Review*, 2003, *17* (1), 27–50.

Bianchi, S., J. Hotz, K. McGarry, and J. Seltzer, "Intergenerational Ties: Alternative Theories, Empirical Findings and Trends, and Remaining Challenges," in A. Booth, N. Crouter, S. Bianchi, and J. Seltzer, eds., *Intergenerational Caregiving*, Urban Institute, 2008, pp. 3–44.

Bourguigon, F., M. Browning, and P. A. Chiappori, "Efficient Intra-Household Allocations: A General Characterization and Empirical Tests," *The Review of Economic Studies*, 2009, *76*, 503–528.

_ , _ , _ , and V. Lechene, "Intra Household Allocation of Consumption: a Model with some evidence from French data," *Annales D'Economie et de Statistique*, 1993, *29*, 137–156.

Browning, M. and P. A. Chiappori, "Efficient Intra-Household Allocations: A General Characterization and Empirical Tests," *Econometrica*, 1998, *66* (6), 1241–1278.

— , **F. Bourguigon, P. A. Chiappori, and V. Lechene**, "Incomes and Outcomes: A Structural Model of Intra-Household Allocation," *Journal of Political Economy*, 1994, *102* (6), 1067–1096.

Chiappori, P. A., "Rational household labor supply," *Econometrica*, 1988, *56* (1), 63–89.

— , "Collective Labor Suplly and Welfare," *Journal of Political Economy*, 1992, *100* (3), 437–467.

Cox, D., "Private Transfers within the Family: Mothers, Fathers, Sons and Daughters," in A. Munnell and A. Sundén, eds., *Death and Dollars: The Role of Gifts and Bequests in America*, Washington, D.C.: Brookings Institution Press, 2003, pp. 168–217.

Dauphin, A. and B. Fortin, "A Test of Collective Rationality for Multi-Person Households," *Economics Letters*, 2001, *71*, 211–216.

Duflo, E., "Grandmother and Granddaughters: Old-Age Pensions and Intrahousehold Allocations in South Africa," *World Bank Economic Review*, 2003, *17* (1), 1–25.

Frankenberg, E. and D. Thomas, "The Indonesia Family Life Survey (IFLS): Study Design and Results from Waves 1 and 2," Technical Report, Rand Corporation March 2000.

— **and L. Karoly**, "The 1993 Indonesia Family Life Survey: Overview and Field Report," Technical Report, Rand Corporation November 1995.

Garces, E., D. Thomas, and J. Currie, "Longer-Term Effects of Head Start," *The American Economic Review*, September 2002, *92* (4), 999–1012.

Horney, M. J. and M. McElroy, "The Household Allocation Problem: Empirical Results from a Bargaining Model," *Research in Population Economics*, 1988, *6*, 15–38.

Kaplan, R. and D. Saccuzzo, *Psychological testing: Principles, Applications, and Issues*, 4th ed., Pacific Grove, CA: Brooks/Cole, 1997.

Lucas, R. E. B. and O. Stark, "Motivations to Remit: Evidence from Botswana," *The Journal of Political Economy*, October 1985, *93* (5), 901–918.

Lundberg, S. and R. Pollak, "Seperate Spheres Bargaining and the Marriage Market," *Journal of Political Economy*, 1993, *101* (6), 988–1010.

— , — , **and T. Wales**, "Do Husbands and Wives Pool their Resources? Evidence from the United Kingdom Child Benefit," *Journal of Human Resources*, 1997, *32* (3), 463–480.

Manser, M. and M. Brown, "Marriage and Household Decision Making: A Bargaining Analysis," *International Economic Review*, 1980, *21* (31-34).

McElroy, M., "The Empirical Content of Nash-bargained Household Behavior," *Journal of Human Resources*, 1990, *25*, 559–583.

— **and M. J. Horney**, "Nash-Bargained Household Decisions: Toward a Generalization of the Theory of Demand," *International Economic Review*, 1981, *22*, 333–347.

Meng, X. and N. Qian, "The Long Run Health and Economic Consequences of Famine on Survivors," 2006. IZA Discussion Papers.

Mwabu, G., "Health Economics for Low-Income Countries," in T. Paul Schultz and J. Strauss, eds., *Handbook of Development Economics*, Vol. 4, North-Holland, 2008.

Rangel, M., "Efficient Allocation of Resources within Extended-Family Households: Evidence from Developing Countries," December 2004. Harris School of Public Policy Working Paper.

Raven, J., "The Raven's Progressive Matrices: Change and stability over culture and time," *Cognitive Psychology*, 2000, *41*, 1–48.

Raven, J. C., *The Standard Progressive Matrices*, San Antonio, TX: Harcourt Assessment, 1958.

Rosenzweig, M. and O. Stark, "Consumption smoothing, migration and marriage: evidence from rural India," *The Journal of Political Economy*, August 1989, *97* (4), 905–926.

Rubalcava, L. and D. Thomas, "Family Bargaining and Welfare," July 2000. California Center for Population Research Working Paper.

— **, G. Teruel, and D. Thomas**, "Investments, Time Preferences, and Public Transfers Paid to Women," *Economic Development and Cultural Change*, 2009, *57* (3), 507–538.

Samuelson, P., "Social Indifference Curves," *Quarterly Journal of Econoimcs*, 1956, *70* (1), 1–22.

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

Silventoinen, K., J. Kaprio, E. Lahelma, and M. Koskenvuo, "Relative effect of genertic and environmental factors on body height: differences across birth cohorts among Finnish men and women," *American Journal of Public Health*, 2000, *90*, 627–630.

Strauss, J. and D. Thomas, "Health Over the Life Course," in T. Paul Schultz and J. Strauss, eds., *Handbook of Development Economics*, Vol. 4, New Palgrave, 2008.

_ **and Duncan Thomas**, "Health, Nurtition, and Economic Development," *Journal of Economic Literature*, 1998, *36* (2), 766–817.

_ **, F. Witoelar, B. Sikoki, and A.M. Wattie**, "The Fourth Wave of the Indonesia Family Life Survey (IFLS4): Overview and Field Report," Technical Report, Rand Corporation, April 2009.

_ **, K. Beegle, B. Sikoki, A. Dwiyanto, Y. Herawati, and F. Witoelar**, "The Third Wave of the Indonesia Family Life Survey (IFLS): Overview and Field Report," Technical Report, Rand Corporation March 2004.

Thomas, D., "Intrahousehold Resource Allocation: an Inferential Approach," *Journal of Human Resources*, 1990, *25* (4), 635–664.

_ **and E. Frankenberg**, "Household Responses to the Financial Crisis in Indonesia: Longitudinal Evidence on Poverty, Resources and Well-Being," in Ann Harrison, ed., *Globalization and Poverty*, University of Chicago Press, 2007.

Waterlow, J., R. Buzina, W. Keller, J. Lane, M. Nichman, and J. Tanner, "The Presentation and Use of Height and Weight Data for Comparing the Nutritional Status of Groups of Children Under the Age of Ten Years," *Bulletin of the World Health Organization*, 1977, *55*, 489–498.

A Tests using PCE

Many papers in the intrahousehold literature test the unitary and collective models by estimating Engel curves. They regress consumption shares on the expenditure of different household members and compare the marginal effects of different family members' expenditure. In this paper, we prefer to look at the effect of different family members' *assets* on human capital *outcomes*. However, to be consistent with the previous literature, we include results for tests of the unitary and collective models using monthly per capita expenditure as the right-hand side variable of interest.[34] As we note in the text, we do not see this as the most appropriate resource measure for our application. Results using PCE comparable to those tests of the unitary and collective models at the household level are included as tables A.1-A.3.[35]

Table A.1 shows results for tests of the unitary model. For regressions which do not distinguish between boys and girls, we reject the unitary model at the 10 percent level for young children's height and cognitive function, and 5 percent level for older children's height and school attendance. Table A.2 reports results for regressions using equation (14), but including household and dynasty PCE as the variables of interest instead of liquid assets. These show stark differences to the results using assets in Table 4. The coefficients on extended family PCE are statistically indistinguishable from zero apart from early child height-for-age. This is an interesting result, and adds support to our use of assets as a marker of resources rather than expenditure. If sharing is done in the first stage of the two-stage budgeting process, and expenditure decisions are made it the second, it is intuitive that dynasty expenditure would have little or no impact on child human capital outcomes in our model. Instead of impacting the preliminary sharing stage, decisions on the allocation of expenditure take place in the second stage.

We include results from nonlinear Wald tests of Pareto efficiency in Table A.3, but do not place much weight on these tests. Although we find rejections of efficiency for boys and girls separately, these are likely due to the imprecisely estimated coefficients on dynasty PCE. Panel A shows that the standard errors on the ratios are large and the ratio estimates for boys and girls separately are all indistinguishable from zero. We remain confident in our use of assets rather than per capita expenditure on the right-hand side of our regressions, and believe that the results presented in the body of the text are more reliable and reasonable than those using expenditure data. Expenditure should be seen as the outcome of the bargaining process, not a distribution factor which influences the first stage of the budgeting process.

[34] PCE is recorded as Rp000 per month, per person.

[35] Because expenditure is only asked at the household level in IFLS, we are not able to perform tests at the individual level.

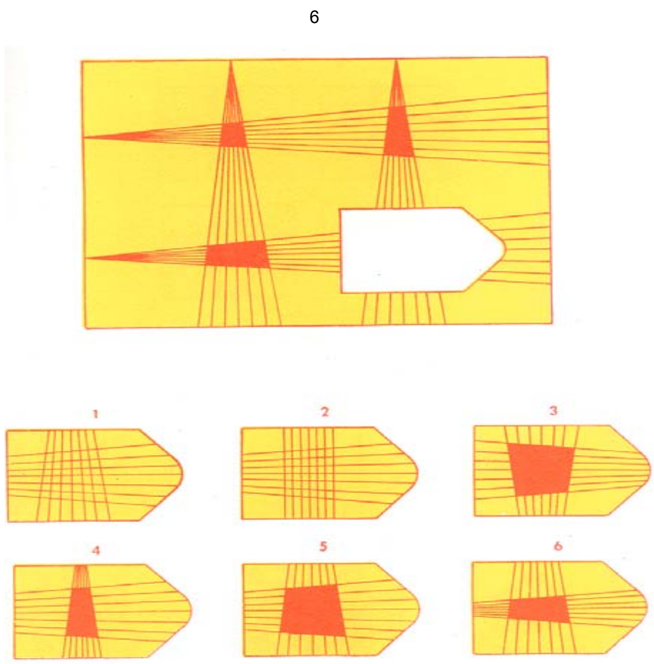

Figure 1: Sample Question from a Raven's Colored Progressive Matrices Assessment

Table 1
Sample Description

Number of unique […]	
Children *(birth - 14 yrs)*	15082
Households	8725
Dynasties	5256
Fathers	7921
Mothers	8681
Grandfathers	3106
Grandmothers	4335

Table 2
Summary Statistics

	Sample				
	All Children (Birth - 14 yrs)	Height-for-Age (6 mo. - 4 yrs)	Height-for-Age (5 - 9 yrs)	Attend Kindergarten (6 - 14 yrs)	Cognitive Score (7 - 14 yrs)
<u>*Outcomes*</u>					
Height-for-Age (z-score)		-1.24	-1.51		
		(0.03)	(0.02)		
Attend Kindergarten (%)				50.8	
				(0.58)	
Cognitive Score (%)					71.2
					(0.24)
<u>*Liquid Assets of […]**</u>					
Household	1772.5	1589.4	1657.1	1680.9	1699.1
	(36.9)	(59.0)	(59.3)	(47.4)	(52.8)
Dynasty	2456.2	2762.3	2423.3	2098.1	2006.8
	(46.0)	(91.6)	(83.0)	(58.2)	(68.7)
Father	854.1	741.5	840.4	850.3	854.5
	(23.9)	(42.6)	(43.4)	(28.4)	(31.8)
Mother	790.8	668.9	789.2	809.0	834.3
	(20.2)	(30.7)	(33.4)	(26.7)	(33.2)
Grandfather	645.3	684.7	538.5	507.1	523.4
	(26.9)	(47.9)	(36.8)	(31.0)	(43.4)
Grandmother	620.8	667.5	556.3	507.7	496.5
	(20.3)	(36.8)	(32.5)	(23.6)	(30.6)
<u>*Additional Controls*</u>					
Age	6.72	2.34	6.96	9.79	10.64
	(0.04)	(0.02)	(0.02)	(0.03)	(0.03)
Female	0.49	0.49	0.48	0.48	0.49
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Co-reside with Mother	0.88	0.96	0.92	0.88	0.86
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Co-reside with Father	0.79	0.87	0.82	0.78	0.77
	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)
Household Size	5.01	4.80	4.96	5.06	5.09
	(0.02)	(0.03)	(0.03)	(0.02)	(0.03)
Dynasty Size	11.57	11.95	11.53	10.86	10.55
	(0.05)	(0.10)	(0.10)	(0.07)	(0.08)
Age of […]					
Father	38.0	33.9	38.1	41.0	42.0
	(0.07)	(0.12)	(0.12)	(0.10)	(0.11)
Mother	33.5	29.4	33.6	36.4	37.4
	(0.06)	(0.10)	(0.10)	(0.08)	(0.10)
Grandfather	61.8	59.9	62.8	64.6	65.6
	(0.13)	(0.21)	(0.22)	(0.20)	(0.24)
Grandmother	58.1	55.6	58.9	61.0	61.7
	(0.11)	(0.17)	(0.19)	(0.16)	(0.20)
Years of Education of […]					
Father	8.82	9.19	8.75	8.30	8.26
	(0.04)	(0.07)	(0.07)	(0.06)	(0.07)
Mother	8.35	9.07	8.25	7.60	7.52
	(0.04)	(0.06)	(0.06)	(0.05)	(0.06)
Grandfather	5.52	5.68	5.29	5.04	5.06
	(0.06)	(0.09)	(0.10)	(0.09)	(0.11)
Grandmother	4.02	4.32	3.76	3.52	3.52
	(0.04)	(0.07)	(0.08)	(0.06)	(0.08)
Maternal Height *(cm)*	151.2	151.5	151.2	151.0	150.9
	(0.04)	(0.08)	(0.08)	(0.06)	(0.07)
Paternal Height *(cm)*	162.3	162.6	162.2	162.0	161.9
	(0.04)	(0.09)	(0.08)	(0.06)	(0.07)
Urban Household	0.52	0.52	0.52	0.50	0.50
	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
N. Observations	15082	3880	4341	7518	5324

* *In Rp0,000 (~ 1 USD)*

Notes: Standard errors in (parenthesis). Column 1 includes all children from birth - 14, and columns two through five show summary statistics for each outcome we consider.

Table 3
Household Unitary Tests

	Height-for-Age (6 mo. - 4 yrs)		Height-for-Age (5 yrs - 9 yrs)		Attend KG (%)		Cognitive Score (%)	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Household Assets	0.10**	0.12*	0.11***	0.07	4.15***	3.99***	1.06**	1.17**
	(0.05)	(0.07)	(0.03)	(0.04)	(0.93)	(1.05)	(0.48)	(0.52)
Household Assets x 1[female]		-0.05		0.09*		0.24		-0.11
		(0.08)		(0.05)		(0.87)		(0.47)
N. observations	3880	3880	4341	4341	7518	7518	5324	5324

*** p<0.01, ** p<0.05, * p<0.1

Notes: All regressions include dynasty fixed effects and liquid assets in log form. Column (2) for each outcome reports coefficients from a model fully interacted with gender to examine differences between boys and girls. Standard errors in parenthesis account for clustering at the family level. Includes controls for gender, age, household size and composistion, parental education, age of the household head and location as described in the text.

Table 4
Household Pareto Efficiency Regressions

	Height-for-Age (6 mo. - 4 yrs)		Height-for-Age (5 yrs - 9 yrs)		Attend KG (%)		Cognitive Score (%)	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Household Assets	0.10***	0.12***	0.08***	0.09***	4.73***	5.10***	1.31***	1.42***
	(0.02)	(0.03)	(0.02)	(0.02)	(0.45)	(0.60)	(0.21)	(0.28)
Household Assets x 1[female]		-0.04		-0.01		-0.77		-0.20
		(0.04)		(0.03)		(0.79)		(0.36)
Dynasty Assets	0.05*	0.06*	0.00	0.00	1.88***	1.74**	0.48**	0.42
	(0.02)	(0.03)	(0.02)	(0.02)	(0.51)	(0.68)	(0.24)	(0.32)
Dynasty Assets x 1[female]		-0.03		-0.01		0.22		0.10
		(0.05)		(0.04)		(0.87)		(0.43)
N. observations	3880	3880	4341	4341	7518	7518	5324	5324
Ratios								
Household to Dynasty Assets	2.14	1.86	96.24	40.42	2.52***	2.93**	2.75*	3.37
	(1.33)	(1.18)	(2,043.50)	(449.73)	(0.76)	(1.25)	(1.52)	(2.74)
Household to Dynasty Assets		2.06		-6.43		2.21**		2.32
(females)		(2.30)		(14.64)		(0.86)		(1.60)

*** p<0.01, ** p<0.05, * p<0.1

Notes: All regressions include liquid assets in log form.Column (2) for each outcome reports coefficients from a model fully interacted with gender to examine differences between boys and girls. Standard errors in parenthesis account for clustering at the family level. Includes controls for gender, age, household and dynasty size and composistion, parental education, age and education of the dynasty head, and location as described in the text. Standard errors for the reported ratios are calculated using the delta method. In column two, the female ratio is calculated as the sum of the household coefficients divided by the sum of the dynasty coefficients

Table 5
Household Pareto Efficiency Tests

Panel A: Ratios

	Height-for-Age (6 mo. - 9 yrs)		Attend KG (%)		Cognitive Score (%)	
	(1)	(2)	(1)	(2)	(1)	(2)
Household to Dynasty Assets	4.01	3.28	2.52***	2.93**	2.75*	3.37
	(2.93)	(2.37)	(0.76)	(1.25)	(1.52)	(2.74)
Household to Dynasty Assets		5.16		2.21**		2.32
(females)		(8.66)		(0.86)		(1.60)

Panel B: Nonlinear Wald Tests (p-values)

		All	Boys	Girls
		(1)	(2)	(3)
Height-for-Age	Attend KG	0.50	0.89	0.90
	Cognitive Score	0.67	0.98	0.98
Attend KG	Cognitive Score	0.88	0.87	0.89
All Ratios		0.93	0.998	0.998

*** p<0.01, ** p<0.05, * p<0.1

Notes - Panel A: Panel A reports ratios from regressions using liquid assets in log form. Column (2) for each outcome reports coefficients from a model fully interacted with gender to examine differences between boys and girls. Standard errors in parenthesis account for clustering at the family level. Includes controls for gender, age, household and dynasty size and composistion, parental education, age and education of the dynasty head, and location as described in the text. Standard errors for the reported ratios are calculated using the delta method. In column two, the female ratio is calculated as the sum of the household coefficients divided by the sum of the dynasty coefficients

Notes - Panel B: Panel B reports the p-values from nonlinear Wald tests utilizing the estimation results in *Panel A*, where the null is Pareto efficiency. Column (1) reports values from tests using the ratios in colum (1) of *Panel A*. Column (2) is for tests using the male ratios from column (2) in *Panel A* and column (3) for tests using the female ratios from *Panel A*.

Table 6
Individual Pareto Efficiency Regressions

	Height-for-Age (6 mo. - 4 yrs)		Height-for-Age (5 yrs - 9 yrs)		Attend KG (%)		Cognitive Score (%)	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Father's Assets	0.05***	0.04	0.02*	0.03	1.55***	1.41**	0.13	0.01
	(0.02)	(0.03)	(0.01)	(0.02)	(0.43)	(0.55)	(0.17)	(0.24)
Father's Assets x 1[female]		0.01		-0.01		0.26		0.30
		(0.03)		(0.03)		(0.71)		(0.32)
Mother's Assets	0.03*	0.08***	0.03**	0.02	2.08***	2.92***	0.79***	0.95***
	(0.02)	(0.03)	(0.02)	(0.02)	(0.44)	(0.57)	(0.18)	(0.26)
Mother's Assets x 1[female]		-0.09**		0.03		-1.65**		-0.35
		(0.04)		(0.03)		(0.76)		(0.34)
Grandfather's Assets	0.01	-0.01	0.01	0.01	0.14	0.28	0.17	0.27
	(0.02)	(0.03)	(0.02)	(0.02)	(0.47)	(0.65)	(0.20)	(0.30)
Grandfather's Assets x 1[female]		0.04		-0.00		-0.20		-0.22
		(0.03)		(0.03)		(0.81)		(0.38)
Grandmother's Assets	-0.00	0.00	-0.01	0.01	1.46***	1.02	0.08	-0.08
	(0.02)	(0.03)	(0.02)	(0.02)	(0.54)	(0.73)	(0.26)	(0.38)
Grandfather's Assets x 1[female]		0.00		-0.05		0.76		0.41
		(0.04)		(0.03)		(0.91)		(0.47)
N. observations	3880	3880	4341	4341	7518	7518	5324	5324

*** p<0.01, ** p<0.05, * p<0.1

Notes: All regressions include liquid assets in quartic root form..Column (2) for each outcome reports coefficients from a model fully interacted with gender to examine differences between boys and girls. Standard errors in parenthesis account for clustering at the family level. Includes controls for gender, age, household size and composistion, age and education of parents and grandparents and location as described in the text. Ratios and their standard errors are not reported for space concerns, but are available from the author upon request.

Table 7
Individual Pareto Efficiency Tests *(p-values)*

Panel A: Boys and Girls Combined

	Height-for-Age and Attend KG			Height-for-Age and Cognitive Score			Attend KG and Cognitive Score		
	Mother	Grandfather	Grandmother	Mother	Grandfather	Grandmother	Mother	Grandfather	Grandmother
Father	0.37	0.15	0.11	0.11	0.21	0.64	0.17	0.07	0.91
Mother		0.20	0.34		0.86	0.69		0.03	0.19
Grandfather			0.40			0.68			0.07
All 6 ratios			0.55			0.68			0.23

Equality Across All Ratios: 0.98

Panel B: Boys Only

	Height-for-Age and Attend KG			Height-for-Age and Cognitive Score			Attend KG and Cognitive Score		
	Mother	Grandfather	Grandmother	Mother	Grandfather	Grandmother	Mother	Grandfather	Grandmother
Father	0.85	0.28	0.48	0.32	0.54	0.89	0.25	0.49	0.89
Mother		0.23	0.47		0.87	0.87		0.24	0.29
Grandfather			0.42			0.87			0.52
All 6 ratios			0.89			0.96			0.72

Equality Across All Ratios: 0.84

Panel C: Girls Only

	Height-for-Age and Attend KG			Height-for-Age and Cognitive Score			Attend KG and Cognitive Score		
	Mother	Grandfather	Grandmother	Mother	Grandfather	Grandmother	Mother	Grandfather	Grandmother
Father	0.99	0.51	0.67	0.40	0.58	0.79	0.28	0.82	0.99
Mother		0.42	0.57		0.99	0.81		0.45	0.41
Grandfather			0.63			0.81			0.80
All 6 ratios			0.98			0.98			0.86

Equality Across All Ratios: 0.34

Notes: Table reports p-values from nonlinear Wald tests of Pareto efficiency. The overarching test at the bottom of each panel is for equality of all ratios across all outcomes (18 ratios). The value in each subsequent cell is for the test using the individual in the row as the numerator, and individual in the column as denominator for the two outcomes listed above. *Panel A* is for boys and girls combined, while *Panel B* and *Panel C* highlight any gender differences.

Table A.1
Household Unitary Tests - Monthly Per Capita Expenditure

	Height-for-Age (6 mo. - 4 yrs)		Height-for-Age (5 yrs - 9 yrs)		Attend KG (%)		Cognitive Score (%)	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Household PCE	0.15*	0.09	0.19**	0.10	4.72**	3.77*	1.72*	2.27**
	(0.09)	(0.13)	(0.07)	(0.09)	(1.88)	(2.27)	(1.03)	(1.15)
Household PCE x 1[female]		0.13		0.22*		2.27		-0.82
		(0.15)		(0.11)		(2.10)		(1.04)
N obs.	3880	3880	4341	4341	7518	7518	5324	5324

*** p<0.01, ** p<0.05, * p<0.1

Notes: All regressions include dynasty fixed effects and monthly household per capita expenditure in log form. Column (2) for each outcome reports coefficients from a model fully interacted with gender to examine differences between boys and girls. Standard errors in parenthesis account for clustering at the family level. Includes controls for gender, age, household size and composistion, parental education, age of the household head and location as described in the text.

Table A.2
Household Pareto Efficiency Regressions - Monthly Per Capita Expenditure

	Height-for-Age (6 mo. - 4 yrs)		Height-for-Age (5 yrs - 9 yrs)		Attend KG (%)		Cognitive Score (%)	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Household PCE	0.19***	0.15**	0.17***	0.14***	8.86***	8.60***	2.02***	2.40***
	(0.05)	(0.07)	(0.03)	(0.05)	(1.07)	(1.34)	(0.44)	(0.60)
Household PCE x 1[female]		0.09		0.07		0.46		-0.80
		(0.09)		(0.07)		(1.73)		(0.79)
Dynasty PCE	0.05**	0.07*	0.02	0.02	0.43	0.89	0.43	0.20
	(0.03)	(0.04)	(0.02)	(0.03)	(0.67)	(0.85)	(0.29)	(0.39)
Dynasty PCE x 1[female]		-0.03		-0.02		-1.11		0.48
		(0.05)		(0.04)		(1.10)		(0.51)
N. obs	3880	3880	4341	4341	7518	7518	5324	5324
<u>*Ratios*</u>								
Household to Dynasty PCE	3.55*	2.08	10.84	5.87	20.83	9.61	4.74	12.27
	(2.10)	(1.71)	(14.39)	(6.97)	(33.35)	(9.53)	(3.67)	(25.60)
Household to Dynasty PCE *(females)*		6.50		2,709.61		-41.21		2.36
		(6.55)		(1,095,788.41)		(164.47)		(1.78)

*** p<0.01, ** p<0.05, * p<0.1

Notes: All regressions include monthly per capita expenditure in log form. Column (2) for each outcome reports coefficients from a model fully interacted with gender to examine differences between boys and girls. Standard errors in parenthesis account for clustering at the family level. Includes controls for gender, age, household and dynasty size and composistion, parental education, age and education of the dynasty head, and location as described in the text. Standard errors for the reported ratios are calculated using the delta method. In column two, the female ratio is calculated as the sum of the household coefficients divided by the sum of the dynasty coefficients.

Table A.3
Household Pareto Efficiency Tests - Monthly Per Capita Expenditure

Panel A: Ratios

	Height-for-Age (6 mo. - 9 yrs)		Attend KG (%)		Cognitive Score (%)	
	(1)	(2)	(1)	(2)	(1)	(2)
Household to Dynasty PCE	5.75*	3.12	20.83	9.61	4.74	12.27
	(3.47)	(2.09)	(33.35)	(9.53)	(3.67)	(25.60)
Household to Dynasty PCE *(females)*		11.74		-41.21		2.36
		(14.95)		(164.47)		(1.78)

Panel B: Nonlinear Wald Tests (p-values)

		All	Boys	Girls
		(1)	(2)	(3)
Height-for-Age	Attend KG	0.37	0.04	0.03
	Cognitive Score	0.48	0.01	0.01
Attend KG	Cognitive Score	0.95	0.10	0.05
All Ratios		0.83	0.04	0.03

*** p<0.01, ** p<0.05, * p<0.1

Notes - Panel A: Panel A reports ratios from regressions using monthly per capita expenditure in log form. Column (2) for each outcome reports coefficients from a model fully interacted with gender to examine differences between boys and girls. Standard errors in parenthesis account for clustering at the family level. Includes controls for gender, age, household and dynasty size and composistion, parental education, age and education of the dynasty head, and location as described in the text. Standard errors for the reported ratios are calculated using the delta method. In column two, the female ratio is calculated as the sum of the household coefficients divided by the sum of the dynasty coefficients.

Notes - Panel B: Panel B reports the p-values from nonlinear Wald tests utilizing the estimation results from *Panel A*, where the null is Pareto efficiency. Column (1) reports values from tests using the ratios in colum (1) of *Panel A*. Column (2) is for tests using the male ratios from column (2) in *Panel A* and column (3) for tests using the female ratios from *Panel A*.