Grandmothers and Granddaughters Revisited: Declines in Health and Within-Household Labor Shares in Kagera, Tanzania

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Abstract

One of the largest shocks to economic opportunity in developing countries is a decline in health. Without affordable, accessible medical care or insurance, households are left to insure themselves against health declines. Using a unique longitudinal data set from Tanzania with several measures of health, I find significant economic and non-economic costs associated with a household member falling ill. When an elderly woman falls ill, estimates suggest adolescent girls living in the same household take up a disproportionate share of the household labor. Adolescent males are not significantly affected. However, I do not find any short- or long-run effect on either the young girl’s or the young boy’s growth or educational attainment.

Keywords: Households, health, economic shocks, family, children, Africa

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1 Introduction

Much has been made of the observation that poverty seems to persist across generations, including debate over the existence of a “poverty trap,” where people experience poverty due to circumstances that are both self-reinforcing and beyond their control. The term “poverty trap” has been used widely by the popular press and is often used to justify tremendous outlays of foreign assistance. (Sachs (2005), published by an economist for a mass audience, is one of the more frequently-cited discussions of the potential for foreign aid to reduce or eliminate the global poverty trap. Easterly (2002) and Easterly (2006) are rebuttals to Sachs’ argument and were also written by an economist for a popular audience.) The existence of a “poverty trap” is contentious, but a strong correlation between a parent’s income level and the income level of his or her child has been observed repeatedly. Part of this relationship is explained by the strong correlation between a parent’s education level and the education level of his or her child, but even that correlation raises questions about the potential for poverty to be transferred between generations. To tease out the effect of a parent’s legacy on children, it is necessary to understand the ways in which families and households operate.

Yet when investigating families and households, existing studies in economics are typically unable to resolve key econometric identification issues concerning endogeneity. Put simply, we know little about the reasons households appear the way they do, and even less about why they change or when they break apart.

We do know households in developing countries operate in volatile and risky environments. Much of the development economics literature focused on households examines the ability of poor households to smooth consumption over unpredictable income shocks and concludes imperfect or nonexistent credit and insurance markets make saving difficult. The majority of these studies do not examine within household allocations and consumption decisions and instead focus on insurance or credit arrangements between households (e.g. McPeak (2006); Rosenzweig and Stark (1989); Udry (1994).) While informal credit and insurance markets help some households, they rarely provide assistance to the very poorest. Little is known
about informal-sector transactions of the very poorest, in part because of the difficulty of data collection. Although incomplete, earlier literature tells a bleak story about the lives of the extremely poor (e.g. Glewwe (1999)).

More recent research has focused on how the extremely poor live their lives. Results from these studies are notable because they discovered several new coping mechanisms used by poor households. Most notable is Banerjee and Duflo (2007), which reviewed previous studies and public datasets to explain “the economic lives of the poor” in four categories: their living arrangements, spending habits, earnings, and “economic environment,” including markets for credit, savings, insurance, and land. The Banerjee and Duflo study questions how the poor adapt to difficult circumstances in the absence of formal systems for pensions, insurance, and savings and uncovered several non-market systems, including a heavy reliance on family and social connections. Families can, in other words, help individuals escape from the specter of vulnerability.

Banerjee and Duflo’s overview represents one of the first attempts to create a comprehensive picture of the lives of the poor. The paper also points to several areas in which economic research is lacking. First, although economists and development experts are beginning to appreciate the importance of personal relationships, we do not understand the ramifications of these relationships within households. Second, prior research on the division of work within households in developing countries is limited. Household work is rarely studied by economists because it is difficult to measure and value without the assistance of a formal system of wages. Nonetheless, virtually every person devotes some portion of his or her day to labor inside the home; in developing countries with poorly-formed formal labor markets, this portion can be significant. Third, research on the elderly in developing countries is lacking. The elderly have been virtually ignored in the development economics literature, save for a handful of papers investigating the effects of a “natural experiment” following an extension of benefits of South Africa’s Old Age Pension. These studies are discussed below. Despite the absence

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1. Eliana La Ferrara (2001)’s paper investigating informal income-generation groups in Nairobi’s informal settlements, or squatter’s communities, is a notable exception.
of a significant literature, the number of elderly adults in sub-Saharan Africa is sizeable, and the proportion needing old-age care is high, making three-generation households common (Cattell (1990).) As family background is an important determinant of both schooling and labor market outcomes, it would be helpful to understand better the division of labor in households that include elderly persons.

My study addresses gaps in the existing literature. It also adds to knowledge of one particularly debilitating hardship a household may face: a decline in one member’s health. While aging certainly takes place regardless of poverty level, it is conceivable that it is more difficult for poorer families to cope with worsening health than less poor families. It is also more likely others in the household suffer when one resident falls ill in the absence of formalized credit and insurance markets.

This paper explores the short- and long-run effects of declines in an older adult’s health on children. Using a panel dataset covering hundreds of households in Northwestern Tanzania, I identify children growing up with older women (likely their grandmothers) and those growing up without them. After showing there are unlikely to be observable differences between the two groups of children, I compare the proportion of household work a child in each family performs and find girls in households with grandmothers do more work. I find no such effect for young boys in households with older women versus those in households without older women.

I then restrict my sample to households with an elderly woman and a young girl and investigate changes in the woman’s health status on the girl’s work share. I quantify a new cost to falling ill, previously unexplored in the literature: when an older woman falls ill and works less, the adolescent female begins to work even more. The household also begins to increase its monthly expenditure on medical goods. As before, an older woman’s illness has no statistically-significant effect on young males. That the younger girl picks up a disproportional share of the older woman’s work suggests her labor within the household may be considered complimentary to that of the older woman. As mentioned previously, I can
find no long-run effect of this increased household labor on the young girl’s anthropomorphic measurements taken during the illness or those taken a decade later, her educational attainment, or her mortality. It is perhaps overly optimistic to suggest the young girl is shielded entirely from the negative effects of her grandmother’s illness, but data presented in this paper suggest she is protected from several potential problems.

The remainder of this paper is structured as follows: Section 2 summarizes previous theoretical and empirical work on the elderly in developing countries and relationships between household members. Sources from both economics and anthropology are considered. Section 3 outlines the methodology employed to determine the effect of an elderly woman’s illness on young children and the extent of the effect, if it exists. Section 4 overviews the data used and pays close attention to the data set’s sampling strategy. Section 5 presents results from the empirical analysis, and Section 6 concludes.
2 Literature Review

This paper is concerned with the dynamics between members of poor families. Within-family dynamics are important because previous research suggests the family responds quickly and collectively to adverse shocks. Earlier research, outlined below, suggests families adjust to changes in economic or social circumstances by re-adjusting allocations and responsibilities within the household before looking outside for assistance. Drawing on the economic literature on within-household allocations, this paper suggests family relationships become increasingly important during times of illness, especially in the absence of market-based mechanisms for medical insurance and health care. It also finds an important role for young females in providing care and support for the oldest generation.

Before outlining the theory behind the noteworthy relationship between elderly females and young females, previous literature on household decision-making, the elderly, relationships between the elderly and children, and children’s role in household allocation in developing economies are reviewed.

2.1 Household Decision-Making in Developing Economies

Previous research suggests households in developing countries use a variety of mechanisms to cope with shocks, including migration and marriage (Rosenzweig and Stark (1989)), livestock sales (McPeak (2006)), increased labor supply (Frankenberg et al. (2004)), informal credit markets (Udry (1994)), transfers from relatives and neighbors (Fafchamps and Lund (2003)), and changes in size (Foster (2004).)

Since many decisions are made at the household level rather than the individual level, it would be helpful to understand how “the household” comes to a certain conclusion. This is a difficult puzzle to solve because endogenous household formation may complicate empirical analysis. In layman’s terms, a particular decision-making process or its outcome may be impacted by what the household looks like, who is in it, where it is located, etc. The potential
for endogeneity confounds the identification of causal relationships between an illness shock and an observed solution or coping mechanism.

Richard Akresh (2007) proposes a clever way to address the endogeneity problem: he restricts the scope of a household’s network. Akresh defines a household’s network only as immediate family members living outside the original household. In doing so, Akresh secures a condition necessary to claim causality but loses some explanatory power: his definition of a household disregards the potentially significant relationships defined along other lines, e.g. by commerce or kinship. Nonetheless, Akresh’s restriction—a “household” is comprised only of individuals who regularly live under the same roof—is useful in shaping a preliminary investigation of a household.

With a working definition of a household, its characteristics can be discussed. Demographer John Bongaarts (2001) set forward four dimensions along which a household can be measured: size, age composition, members’ relationship to household head, and complexity. Bongaarts also highlights the interaction between the sex of the household head and household structure and between household size and structure as important to understanding dynamics within the household.

Bongaarts defines household size as the number of individuals who “usually” live together. Historically, this has been a noncontroversial measure and is obtained easily from survey data. Early economics work on household size and theories of the family was concerned with the existence of economies of scale. The underlying rationale is simple: the price of household public goods (e.g. consumer durables) falls with household size, thereby increasing the share of total income left for household private goods (e.g. food) unresponsive to changes in household size. Theory predicts a positive relationship between income earners and calorie consumption within a household, and another positive relationship, albeit a smaller one, between household size and calorie consumption. Early empirical work did not follow the theory. Using cross-country regressions, Deaton and Paxson (1998) find a significant, negative relationship between family size and food shares using household data
sets from both developed and developing countries. They suggest several explanations for the apparent paradox, including direct economies of scale in food consumption, economies of scale in food preparation, and intra-household inequality, but were unable to test any of them. Anjini Kochar (2000) addressed Deaton and Paxson’s paradox using data from rural Pakistani households in which adult sons and elderly fathers lived together. Kochar suggests Deaton and Paxson’s empirical work failed to account for the effect of family size on the price of other goods beside food. Kochar’s empirical work demonstrates the negative effect of family size on per capita food consumption operates primarily through changes in the number of work days of the adult son. Her work suggests the cost of leisure is also responsive to changes in household size, which implies individual preferences may impact the degree to which households exhibit economies of scale.

Household size alone is probably less important if the household considers other households in its decision-making process. These other households might be those of family members or friends living closeby. For example, a nearby relative may be able to help around the house when an elderly person falls ill. Even though the relative does not live with the ill person, he or she may have some tie to the family and its well-being. Under circumstances like these, decisions of the two households may not differ substantially from decisions of a joint household. First, even when allocation decisions concern only one person, it may be difficult to determine the extent to which he or she makes decisions alone. Andrew Foster (1993) examines recently-partitioned households to determine the extent to which now-separate households share resources with previous household members. He uncovers differences in children’s educational outcomes between recently-partitioned households but not in single households, implying newly-split households do not act as a single household because they do not share all their resources. Foster chooses children’s educational attainment as the outcome of interest for three reasons: (1) decision-makers in recently-seperated households would not consider it a pure, “public household good”; (2) significant differences exist between households in children’s educational attainment; and (3) controlling for age
and sex, small differences were expected between children’s educational attainment in the same household. The third criterion, which suggests only age and sex differentiate children’s educational attainment within a household, depends on strong assumptions about parent’s preferences and budget constraints that may not hold. If these assumptions fail and parents do not equalize outcomes across their children, Foster’s choice of instrument is inappropriate, and his conclusions may be misleading. Still, Foster’s hypotheses have support elsewhere in the empirical literature. In a working paper, Manuela Angelucci, Giacomo de Giorgi, Marcos Rangel, and Imran Rasul provide evidence that poverty levels in rural Mexico are more correlated between two households in the same family network than between two randomly-chosen households (Angelucci et al. (2006).) Their results follow a large body of research suggesting income shocks are correlated across households of the same family and that family network are pervasive.

Second, composition of the household in terms of age and gender may also impact household decision-making. Angelucci et al. (2006)’s investigation into family networks of Mexico’s rural poor also finds poverty levels are more closely correlated along parent-son and head of household-parent links than the corresponding female-defined links. Again, causality is difficult to establish, but the research suggests gender of the family member in the new household may be an indirect signal of household income and may also be an important determinant in measuring the strength of family ties. The relationship described in rural Mexico appears outside of North America as well. Specifically, single-adult, female-headed households are significantly poorer than two-parent households in Nigeria, controlling for head’s educational status, region of residence, number of children, and type of home. Increasing the number of females in the household does not raise living conditions above the average level, while extended male-headed households tend to be better off than two-parent households (Mberu (2007).)

Third, earlier research suggests it matters which household member is affected by a par-

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2Esther Duflo (2003) discusses a scenario under which adults’ budget constraints appear to differ between male and female children, resulting in different outcomes at different income levels.
ticular shock. Gertler and Gruber (2002) find families suffer significant economic costs when the household heads fall ill. Furthermore, their empirical work suggests informal insurance is an insufficient shield to the loss of household income, so other family members consume less following a household member’s illness. Serious illness has the potential to affect household composition as well. Households may split apart following a serious illness or death if the ill person had provided irreplaceable financial or emotional support to other members of the household. According to anthropologist Goodwin Unanka (2002), elderly women in Nigerian households provide the bulk of the emotional support for the family and act as confidants, mediators and in some cases, “hold the family together” during times of stress. Alternatively, non co-resident family members may be more likely to move into the household following a household member’s illness or death with the aim of supporting the remaining family members. In rural Kenya, primary care-taking responsibilities for children orphaned by AIDS are likely to fall to grandparents (Nyambedha et al. (2003).)

Fourth, the economics literature supports the importance of what Bongaart terms complexity, or a measure of individual turnover within the household. Demographic trends from developed countries suggest the number of adults and number of children in a household declines over time, as the country industrializes (Bongaarts (2001).) This reflects a shift from multi-generation households towards smaller households composed of the nuclear family. No empirical work has described the role of older adults in households in sub-Saharan Africa, but in rural Bangladesh, co-resident female family members tend to be better nourished than non co-resident female family members, suggesting household members feel more altruistic toward nuclear family from their household than extended family from a different household (Foster (2004).)

2.2 Elderly in Developing Economies

While the decisions of working-age adults in developing economies are well-studied, the decisions of older adults have received comparatively less attention. For this, some fault
an under-appreciation of the contributions of the elderly. Armando Barrientos et al. (2003) suggest academic researchers falsely consider the elderly “ghosts,” who live in the household without contributing to or consuming in it. It is also true children’s decisions are rarely studied, but most of the literature assumes children do not have sufficient bargaining power to consistently make decisions for themselves. Earlier literature that concerns children’s roles in households is discussed in Section 2.4.

The scarcity of knowledge about the behavior of the elderly in developing economies is more surprising given their over-representation among the rural poor. Demographic trends suggest the number of elder persons in sub-Saharan Africa will more than quadruple, while the overall population will increase only 1.25 times (United Nations (1999); Unanka (2002).) The HIV/AIDS epidemic in sub-Saharan Africa, which primarily strikes prime-age adults, is the most-frequently cited explanation for these demographic patterns. If households contain one or fewer prime-age adults, the elderly will be forced to take on a larger role in household affairs; whatever retirement they had expected will have vanished.

Without the support of prime-age adults, Africa’s aging and elderly face an increasingly dire situation. Compounding the problem is the absence of medical insurance, old-age pensions, or formal elder care. Theories from sociology suggest later life is associated with an increased probability of experiencing poverty, resulting in a ‘U’-shaped relationship between age and poverty (Unanka (2002).) Empirical work in developed and developing countries has generally supported this relationship. Yet simply knowing the elderly are prone to poverty has not translated to policy interventions. Barrientos et al. (2003) find elderly are made more vulnerable by the absence of formal elder care and traditional pension programs, leaving them dependent on informal family care. Informal family care is common; descriptive statistics provided by Zimmer and Dayton (2005) suggest 59 percent of elderly adults in sub-Saharan Africa live with a child, and 46 percent live with a grandchild. To determine which family member bears a disproportionate share of that cost, it is necessary to understand the role of an elder person within a family.
Much of the literature on family structure in sub-Saharan Africa describes elders at the
top of family hierarchies. Anthropologist Maria Cattell (1990) suggests grandparents hold
a revered position inside and outside the family. Within close communities, the elderly are
viewed as indicators of a family’s goodwill and altruism. Given the esteem with which the
elderly are held, it is unsurprising that elder care is viewed as a duty, rather than a burden, in
many parts of sub-Saharan Africa. Yet even if the “duty” is viewed positively among younger
generations, the elderly are still dependent on the willingness of family members to take on
that duty. That duty increases during times of illness. While the responsibility for elder
care used to be shared among the greater family, it has recently shifted toward the elder’s
immediate family of the spouse and adult children (Unanka (2002).) The transition toward a
smaller network of potential caretakers increases uncertainty in an elder’s plans for old age;
the uncertainty is further compounded by the HIV/AIDS epidemic, which disproportionately
impacts prime-age adults. If their adult children cannot provide adequate care, the elderly
may turn to the youngest generation—their grandchildren.

The discussion of elderly care as a duty is not meant to imply the elderly do not con-
tribute to their households, families, and communities. Beyond traditional roles as confi-
dants, advisors, and healers, the elderly support individuals within the household, especially
its younger members. Maria Cattell (1994) articulates an elder woman’s role among Kenya’s
Abaluyia: grandmothers traditionally served as advisors to granddaughters. In return, grand-
daughters provided companionship and mediated mother-in-law/daughter-in-law conflicts.
Under some circumstances, both grandparents and granddaughters benefited from the multi-
generational relationship. Erick Nyambedha et al. (2003) describes changes to the role of the
elderly within families among Kenya’s Leo: due to the HIV/AIDS epidemic, more and more
elderly adults (primarily grandmothers) are responsible for caring for children whose parents
have died. The grandparents are forced to resume the role of a parent, and they often do
so without a steady income or good health. In households without prime-age adults, elderly
caretakers certainly support their families. Finally, Walter H. Sangree (1987) describes a
trade-off between the social position of elders and that of young men. Sangree studied the Tiriki society in Kenya and in the Irigwe society in Nigeria and posited that access to Western education has increased the social status of young men at the expense of the social status of elderly men and of women of all ages. If dynamics within households should be thought of as a zero-sum game, as Sangree suggests, it is important to understand when and why multi-generation households exist.

Even in countries where reverence for the elderly is strongest, it is difficult to find evidence that family members feel more altruistic toward the elderly than toward younger family members. It is, of course, difficult to distinguish altruism from duty or another social mechanism that results in the same observable allocation within the household. Furthermore, taking at face value the desires for old-age care professed by prime-age adults may be naive. They are unlikely to identify a specific young child as their “retirement plan” or safety net, and retrospective questions about preferences for old-age care will be influenced by ex-post rationalization. Compounding the problem is the difficulty of observing whether the elderly have always expected to receive care from their family. Neither personal reports nor observations can be used as an instrument to assess the determinants of an elder person’s presence in a particular household. To get around these problems, another instrument must be found to address the problem of endogenous household formation. This would allow us to approximate what would happen if every household was formed for the same reasons and in the same way, not each under idiosyncratic circumstances. Previous studies have not introduced such an instrument.

The appearance of an elderly adult in a particular household may only be partially explained by the preferences of his or her son. The move is likely the result of a negotiation in which members of the household also expressed preferences. For the elder person, living with family members may provide important benefits: reduction of housing costs, interaction

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3 The difficulty of measuring unobserved differences between professed desires and actual desires for old-age care runs parallel to reasoning put forward by Lant Pritchett (1994) concerning the difficulties of estimating a woman’s true desired fertility level.
with children and other family members, and more efficient old-age care with fewer costs, namely a loss of independence and privacy. As discussed above, the elderly person may be able to provide key advising and care-giving roles for the family. These benefits must be weighed against the financial and non-financial (e.g. time) resources devoted to elderly care. Unfortunately, there is not a literature describing bargaining between family members over old-age care in developing economies.

Empirical work has investigated the caring and living arrangements of the elderly in developing economies and has found preferences are sufficiently flexible that policy affects them. Thomas J. Hoerger et al. (1996) examines substitution between market- and family-care of the elderly in the United States and finds direct government subsidies for nursing-home care significantly increased the number of elderly who chose to enter a nursing home, while government subsidies that limit the number of beds in nursing homes or the reimbursement for care significantly decreased the number of elderly who chose to enter nursing homes.

Likewise, there is evidence elderly adults may not always be welcomed into the house. Edward Miguel (2005) suggests that if elderly adults join a particularly resource-strapped household, an economic shock may force their premature exit. Miguel investigated murders of elderly women who had been accused of witchcraft in ethnically-Sukuma western Tanzania. He identified income shocks as a key underlying cause of the murders. Miguel’s instrument was extreme rainfall (either droughts or floods), which is exogenous, causes a large drop in income — and lead to a doubling in the number of elderly women who were called witches and then killed. Further, nearly all of the “witches” were elderly women and were typically killed by their own relatives. Miguel’s novel study provides concrete evidence that economic conditions affect household composition. It also suggests elderly females may be particularly vulnerable to economic shocks.
2.3 Elderly and Children in the Same Household in Developing Economies

Without access to formal savings or pension programs, the elderly in developing countries tend to rely on informal family care in their old age. Informal family care generally takes two forms: first, that adult children transfer income to their elderly parents, perhaps to repay the parents’ earlier investments in child-rearing or schooling. Baland and Robinson (2000) and Rogers and Swinnerton (2004) offer theoretical approaches to a parent’s maximization problem of their child’s lifetime earnings. Parents may choose to invest early in a child’s human capital in hope of benefiting from transfers many years in the future, or they may send the child to work and receive his or her wage immediately. While the wage of an uneducated child would be lower than the wage of an educated adult, it would be available many years in advance. The timing of payments may be particularly important for a credit-constrained household. The relationship between remittances and educational attainment is investigated empirically by Lucas and Stark (1985) in rural Botswana, Rosenzweig and Wolpin (1993) in the United States, Lillard and Willis (1997) in Malaysia, and Cox et al. (1998) in Peru. The second form of informal family care, which is this paper’s primary concern, occurs after the elderly adult chooses to move in with one of his or her adult children. The elderly adult may help out around the home, but if he or she falls ill, members of the household are now concerned with providing for his or her direct care. None of the empirical literature set in developing countries discusses this second type of family care.

As discussed, poverty and imperfect credit markets increase the prevalence of multi-generation households in sub-Saharan Africa. However, it is not clear what motivates an elderly adult to live with a particular household; nor is it known how the presence of an elderly adult affects allocation decisions of the new, larger household. The majority of the literature suggests older adults view moving in with the family of an adult child as an implicit transfer. Kochar’s research on intergenerational households in rural Pakistan tests this hypothesis. Kochar first observes a correlation between the number of work days reported by
elderly fathers and the incomes of co-resident adult sons, suggesting sons may be contributing to their father’s lifetime wealth. However, empirical tests reveal no significant evidence that fathers and co-resident adult sons entered into either an income- or a risk-sharing arrangement. Instead, the introduction of the father into the household appears to consolidate total expenditure on household public goods (e.g. consumer durables and ceremonies) rather than alter proportional allocations of household private goods. It appears fathers derive their primary benefit of living with their adult sons from the joint consumption of household public goods. Kochar’s study provides empirical support for the hypothesis that families can demonstrate economies of scale.

Few studies have investigated grandparents’ role in household allocations and decisions. A notable exception is research by Case and Deaton (1998), Esther Duflo (2003), and Eric Edmonds (2006) following the rapid expansion of South Africa’s Old Age Pension program to blacks at the end of apartheid. By 1993 in South Africa, the Old Age Pension program covered 80 percent of black women over age 60 and 77 percent of black men over age 65. Their pension was capped at 370 rands per month, which was one-half of minimum wage. At approximately twice the median per-capita income in rural areas, the transfer was significant enough to affect budget constraints and decision-making. Grandmothers living with grandchildren were common among the pension recipients: nearly one-third of black children younger than five lived with a pension recipient. Duflo investigated changes in nutrition (reflected in anthropomorphic measurements) of these children and found girls living with a grandmother who received the pension were taller and heavier than girls of the same age who did not live with a pension recipient, controlling for family background. The girls’ improvement in nutrition was enough to make up one-half the gap between size of girls in the United States and in South Africa. No such effects were found when the pension recipients were grandfathers or for young boys who lived with a pension recipient of either gender. Duflo’s paper suggests grandmothers and grandfathers have different preferences and use their leverage in the household to achieve different outcomes.
Despite differences between grandmothers’ and grandfathers’ preferences, grandfathers’ decisions need not always hurt grandchildren. Eric Edmonds (2006) investigated the effect of the same pension reform in South Africa on secondary school (ages 13 to 17) enrollment. He found that among adolescents living with an eligible adult, those living with eligible males were more likely to be in school than those living with eligible females. Boys showed more dramatic declines in hours worked and increases in schooling completed than girls. Meanwhile, girls spent less time on household chores after their household received the pension than before but still spent more time than boys on household chores. The effects on hours worked and schooling completed are not significant for boys or for girls when the pension recipient was female.

Foreshadowing the results of Duflo (2003) and Edmonds (2006), Case and Deaton (1998) showed the effects of the South African Old Age Pension program on household spending are contingent on the pension recipient’s gender. The study found female-headed households spent less on alcohol and tobacco. It was unclear whether male pension recipients altered the amount spent on alcohol and tobacco.

Building on the earlier studies, Eric Edmonds et al. (2005) found prime-age women tended to leave households when a co-resident female received a pension, while younger women and children under age five tended to join those same households. The authors suggested the pension income allowed the older women to exploit their comparative advantage in working away from home and substitute household labor from the younger women. The pension relaxed elderly females’ budget constraints and lead to changes in household structure. Given these results, this paper will look for changes in young girls’ and young boys’ outcomes separately.

2.4 Children and Household Allocation in Developing Economies

Economists’ theories of household allocations are founded on the assumption that families are composed of individual actors seeking to maximize their own utilities through a bargain-
ing process. Utility is an individual measure that can capture altruism, kinship, or any other preference and has been extensively explored in the literature (e.g. Becker (1974) for seminal theory, and Manser and Brown (1980); McElroy and Horney (1981) for subsequent refinement and clarification.) Subsequent theoretical research suggested actors use different bargaining models to sort out situations when individual utilities conflict (e.g. Lundberg and Pollack (1996).) The general theory of household bargaining has held up to empirical tests, although the precise specification has changed based on context, time, and study design. (For example, see Dercon and Krishnan (2000) for an investigation into bargaining between husbands and wives in rural Ethiopia.) Nonetheless, two facts about household allocation are widely accepted: first, that children do not have bargaining power, and second that in some parts of the world, boys and men are favored over girls and women.

The latter conclusion is based in differences in nutrient consumption and educational outcomes across genders. Angus Deaton (1989, 1997) found no evidence that households reduce consumption of “adult goods” (e.g. cigarettes, alcohol, or adult clothing) more for a boy than a girl. However, sex discrimination may still be present in these families, as changes to household expenditures immediately following births are not the only source of differential treatment between boys and girls, and gender discrimination may intensify as girls age. Elaina Rose (1999) concluded poorer Indian families faced with financial shocks tend to sacrifice the welfare of girls disproportionately to the welfare of boys when she discovered young girl’s mortality rate rises dramatically and quickly during droughts, while young boys’ mortality rate remains constant. More persuasively, Rose did not observe the same increase in girls’ mortality when the family owned assets before the drought; presumably, the family was able to sacrifice its accumulated wealth rather than its daughter.

Even if not fatal, shocks to a girl’s welfare may have effects reaching far into adulthood. In many developing countries, girls enroll in school at lower rates than boys do. The gap increases with each level of school: primary, secondary, and tertiary. Even when enrollment rates are near equal, girls still attend school less frequently, both in terms of days in a school
year and hours in a school day. The ties between primary education and lifetime earnings is well-documented at both the micro (see Filmer and Pritchett (1999) for more) and the macro (see Romer (1986) for more) scale. In brief, a significant part of the variation in adult wages in developing countries can be attributed to variance in individual education levels.

A child’s outcomes are determined by more than individual characteristics; family is also important. Duncan Thomas (1994) looks at families in three very different countries (the United States, Brazil, and Ghana) and finds a strong relationship between parental education and child’s nutritional status. The effects are dependent on the parent’s sex and carried across the three countries. Specifically, Thomas discovers the mother’s education has a larger effect on the daughter’s height and the father’s education has a larger effect on the son’s height, suggesting differences in household allocation dependent on the child’s gender. Other research suggests that differential treatment can continue into adulthood. Dercon and Krishnan (2000) found Ethiopian women in poor households suffered disproportionately from adverse shocks, especially in the south of the country where divorce laws and norms are less favorable to females.

Another outcome of interest to researchers and development experts is a child’s nutritional status. Child malnutrition and stunting are measured by BMI and height-for-age and weight-for-height z-scores. Z-scores are frequently used in the economics literature to approximate a normalized effect of a certain event, e.g. childhood malnutrition (Duflo (2003) in South Africa), labor (Suri and Boozer (2007) in Ghana), and exposure to conflict (Richard Akresh et al. (2007) in Burundi.) Childhood malnutrition is of particular concern because earlier studies have shown links between children’s nutrition levels and performance in schools (e.g. Maluccio et al. (2003) in Zimbabwe.) Poor childhood nutrition is an outcome of significant interest to researchers, policymakers, and development practitioners because its effects are far-reaching.
2.5 Focus of the Present Investigation

Previous research by Daron Acemoglu et al. (2001), among others, suggests institutional differences across countries may explain differences between macroeconomic growth patterns. This paper explores a particularly widespread practice in developing countries, in which children perform a large share of the household chores. Younger females in particular are expected to help around the home by cooking, cleaning, caring for others, gathering firewood, and fetching water. While children in developed countries certainly perform household chores, they are likely to have fewer responsibilities and live in families that place a greater emphasis on education.

In this paper, I seek to answer two questions. First, I evaluate the immediate impact of a decline in an elderly female’s health on children and compare the effects by the child’s gender. Then, I investigate the effects of young girls’ increased work hours on their growth, as reflected in three anthropomorphic indicators: BMI, weight-for-height and height-for-age. I also take advantage of the dataset’s longitudinal set-up and look at anthropomorphic indicators during childhood, when the elderly woman fell ill, and during young adulthood, at least a decade later. Each measure is conditioned separately on the presence of an elderly woman, her health status, and the hours the child worked. My identification strategy is uncomplicated, as I was unable to find significant observable differences between children living with elderly women and children living without them. Understanding the impact of changes to household demographics on the youngest generation may uncover a “poverty trap” if declines in welfare of older adults tend to make children worse off.
3 Methodology

This paper attempts to answer two empirical questions about the impact of health declines on child welfare. First, are children affected by changes in the health of elderly women in the same household? Previous studies find an effect of individual illness on household welfare, but they often employ crude definitions of illness. This study moves beyond a standard, binary ill/healthy measure and takes advantage of new and more complete data to obtain better evidence for the conditions under which an individual’s illness affects other household members’ welfare. Very few of these elderly women earn wages, so we would not expect to find detrimental effects of illness on household wealth, unless household medical expenditures rose sharply. Given the income and credit constraints on the households in the Kagera study, I do not expect the effect of an illness to operate primarily through income channels.

Second, if there is some effect on young children, to what extent is that effect permanent? Put differently, is there a long-run detriment to growing up with a sick grandmother? If the effect is permanent, the idea of a poverty trap becomes more compelling. As discussed in the previous section, a tremendous body of development economics literature suggests the existence of significant differences between the treatment of boys and girls in families in developing countries. Therefore, I look at the effects of a family member’s illness on boys and girls separately. The short-run and long-run outcomes of interest also follow from the earlier literature. I look at the anthropomorphic measurements of weight-for-height and height-for-age to approximate the relationship between work intensity and nutritional status. The illness of a non wage-earner may reduce household wealth by increasing the household’s medical expenditures. If the income decline is large enough, per-capita food consumption may also fall. Working more and eating less should translate into smaller children, and eventually, stunted growth. Therefore, I also look at the same anthropomorphic z-scores ten years later to test for long-run effects of more household work on growth.

The rest of the section is divided into four parts. I first overview the methodology used to determine the extent to which an elderly woman’s health decline affects her own labor share
and her household’s medical expenditures. Then, I detail the methodology used to discover whether an elderly woman’s health decline has an effect on a child’s labor share and whether those effects are detrimental to young children in the long-term.

### 3.1 Does Health Affect Labor Shares?

I first use the data to establish that illness reduces the share of labor an individual contributes towards his or her household. Following other papers examining the determinants of household allocation (Gage et al. (1997); Bongaarts (2001); Foster (2004); Akresh (2007)), an elderly woman’s labor share depends on a series of demographic characteristics, a series of household characteristics, and a measure of individual health. Demographic characteristics of interest include the elderly woman’s age, which enters into the equation linearly and quadratically, and a dummy variable for whether or not the woman is married. I expect married women to perform more work in the household for three reasons: their husbands increase total household size, are more likely to be somehow ill or disabled because of age, and are unlikely to perform the household chores themselves.

Household characteristics of interest include the household size and household assets. The Kagera survey collected information on household assets, but the measures may be unreliable; reports are missing in approximately one-third of observations, and the variance of the data in the other two-thirds of cases is wide. Therefore, I use a measure of household income to proxy for a measure of household assets. Income is entered as a logarithm so that a percentage increase in monthly income raises the elderly woman’s household labor share by $\beta\%$, where $\beta$ is the coefficient on the log household income variable in the regression results presented in Section 5.

I estimate labor supply within the household using the following specification:

$$L_{ij} = \alpha + \beta h_{ij} + \phi X_{ij} + \varepsilon_{ij}$$

which is a regression of labor share for elder women $i$ in household $j$ against the measure
of health \((h_{ij})\), a series of demographic controls \((X_{ij})\), and a random error term \((\varepsilon_{ij})\). The coefficients are estimated using the ordinary least squares (OLS) method, and results are presented in Section 5.

### 3.2 Does Health Affect Household Medical Expenditure?

Second, I estimate the effect of poor health on household medical expenditure. If an illness is detrimental enough to affect the individual’s share of labor in the household, it may have a monetary cost as well. I estimate the effect of illness on household medical expenditure next. This is worthwhile because it, along with Equation (1) above, helps quantify the monetary and non-monetary costs of illness. It is possible that both are essential to explaining the distribution, or allocation, of the negative effects of illness within a family.

If health declines are expected to increase household medical expenditures, it is possible that wage-earners are expected to increase household income to make up for the difference. If so, this might take them outside the home even more and leave chores for those household members left inside — namely, the children. In brief, a fuller understanding of the monetary costs of an illness may help explain the non-monetary costs of an illness.

For the sake of consistency, I estimated household medical expenditure using a specification similar to the one used to estimate household labor supply above. The only difference between Equations (1) and (2) is the left-hand side variable: individual labor share in Equation (1) and medical expenditure in Equation (2). Therefore, I propose the following specification to estimate the effect of health status on household medical expenditures:

\[
E_j = \alpha + \beta h_{ij} + \phi X_{ij} + \varepsilon_{ij} \tag{2}
\]

which is a regression of monthly medical expenditure in household \(j\) against a particular measure of the elderly woman’s health \((h_{ij})\), a series of demographic controls \((X_{ij})\), and a random error term \((\varepsilon_{ij})\). The coefficients are estimated using the ordinary least squares (OLS) method, and results are presented in Section 5.
3.3 Do the Health Declines in Elderly Females Affect Young Children?

If I find a detrimental effect of either illness or a decline in general health on an individual’s labor shares, I next look at the effects of that health decline on a child living in the same household. I propose studying children as a useful “upper bound” to the average effect on all other household members. As discussed above, children have little bargaining power within the household and are subject to the entire effect, or nearly all of it, whether it be positive or negative. Understanding better what happens to children after a relative’s illness may contribute to an understanding of what happens to other members of the household after an illness.

The individual controls are taken from earlier literature and include the child’s age, the child’s academic ability, and the opportunity cost of his or her attending school. Unfortunately, data were not collected on children’s test scores or overall academic ability. Instead, I use the child’s ability to perform basic arithmetic as a proxy for his or her academic ability. I construct a binary variable, with a ‘0’ indicating an inability to perform basic arithmetic and a ‘1’ indicating full ability or competency. Arithmetic skills are more likely to be learned in the school than in the home, and especially younger children with this ability are likely to have attended or currently be attending primary school. It is also difficult to measure the total cost of attending school. One way to approximate part of the cost is to use a measure of the kilometers to the nearest primary school (Nancy Birdsall (1985); Case and Deaton (1999)). In Kagera, all children in the sample that attend primary school walk there. However, the further away school is, the more time must be spent in transit, which could conceivably decrease the time spent in the classroom or the number of days on which school is attended.

The demographic controls follow those of the earlier specifications. Namely, household size and household income enter into the model. Both are entered logarithmically so their effects may be measured as a percentage change.
Building on Equation (1) above, I use the following model to estimate the effect of changes to the proportion of household work an elderly woman completes to the work completed by an adolescent:

\[ L_{ij}^* = \alpha + \beta w_{ij} + \phi X_{ij} + \lambda T_{ij} + \varepsilon_{ij} \]  

(3)

which is a regression of labor share for adolescent \( i \) in household \( j \) against the work share of the elderly woman \( w_{ij} \) in the household, a series of demographic controls \( X_{ij} \), a series of individual controls \( T_{ij} \), and a random error term \( \varepsilon_{ij} \).

Coefficients are first estimated using the ordinary least squares (OLS) method, and results are presented in Section 5. I expect a negative and significant relationship between the proportion of household chores completed by the elderly woman and the proportion completed by the child. For reasons discussed above, I separate out the effect on young girls from that on young boys. As before, I expect the effect on girls to be more extreme.

At this point, I have made two hypotheses: first, that illness and health declines decrease an individual’s labor share within the household, and second, that a decrease in a fellow household member’s labor share will increase the female child’s labor share. If both hypotheses are shown to be valid, I combine them and estimate the effect of a fellow household member’s illness on a child’s labor share. I do this by re-estimating Equation (3) using the instrumental variables (IV) technique. IV is the standard way to estimate consistently the parameters of a linear model with an endogenous explanatory variable, omitted variables, or measurement error in the explanatory variable. An instrument is a variable that is correlated with the explanatory variable, \( L_{ij} \) but is uncorrelated with the error term \( \varepsilon_{ij} \). If the instrument is chosen properly, the IV technique produces consistent estimates for a linear system. For the purposes of this study, I am most concerned with the potential endogeneity of the elderly woman’s labor share within the household. To this end, I instrument for labor share using the three different measurements of the elderly woman’s health. It is conceivable that the elderly woman’s health status is correlated with the work share of a young girl but is no
correlated with the error term of regression Equation (4) than a direct measure of the elderly woman’s labor share.

Fixed effects cannot be used to estimate these equations, so community-level effects, or unobserved heterogeneity that is constant over time, are not controlled for. Leaving community-level heterogeneity uncontrolled for may bias the subsequent estimations. Omitted variable bias affects the parameter estimates in a regression equation. Nonetheless, in spite of these potential estimation problems, the instrumental variables technique is a powerful way to control for an endogenous explanatory variable. I expect the IV regression to yield less biased coefficients than the OLS regression.

Using IV, the expected sign on all three health coefficients is negative. For reasons discussed above, I expect to find stronger evidence of significance using the instruments of recent illness and overall health status. I also expect the coefficients on the estimated parameters will be statistically different from the OLS estimated coefficients, revealing the endogeneity of the first regressor. It is worth noting the point estimates from the IV regression equations measure the local average treatment effect (LATE), rather than the average treatment effect (ATE). The effect of elderly women’s work shares on girls’ labor shares is only identified for the subpopulation of girls affected by changes in the woman’s health status. Fortunately, my sample is already restricted to adolescent girls and adolescent boys living with an elderly woman, and the vast majority of these woman report some decline in overall health status. (Table 2 includes the descriptive statistics for women’s health in the sub-population.) In this case, it is conceivable that the LATE and ATE are not statistically different.

3.4 Do Changes in Family Members’ Health Affect Young Children in the Short and Long Run?

If children are affected by declines in health of other household members, I next attempt to approximate the magnitude of the effects in the short- and long-run. I am interested in three particular outcomes for children: his or her Body Mass Index (BMI) and z-scores for
his or her weight-for-height and height-for-age.

Body Mass Index and weight-for-height calculations are made for each child. While using both measurements may seem redundant, together the two give a fuller picture of a child’s size. Body Mass Index is used more often in developed countries, while weight-for-height is the standard measurement used by the World Health Organization (2006) to track child growth. I expect the point estimates in the BMI model and the weight-for-height measurements to be similar. I least expect to find significant effects of illness on a child’s height-for-age measurement. Height is insensitive to short-run changes in nutrition and health; instead, as Esther Duflo (2003) noted, height better reflects an accumulated investment in a child’s health and nutrition since birth. Furthermore, growth deficiencies often reflect inadequate nutrition and infections; neither is directly relevant to this study. While an elder’s illness may eventually lead to a child consuming insufficient calories, this is a slow-moving effect (Martorell and Habicht (1986)).

Following other papers examining the magnitude of child malnutrition and child labor (Duflo (2003) in South Africa, Suri and Boozer (2007) in Ghana) a child’s anthropomorphic indicator depends on a series of individual characteristics, a series of household characteristics, and a measure of the elderly female’s health. Individual characteristics of interest include the child’s age, which enters into the models linearly and quadratically.

Household characteristics of interest include household assets and size. As discussed above, a measure of household income is used to proxy for household assets. The measure enters into the model logarithmically so that a percentage increase in monthly income affects the child’s predict anthropomorphic indicator by $\beta\%$, where $\beta$ is the coefficient on the log household income variable in the regression results presented in Section 5. Household size is also entered logarithmically into the model to allow for the existence of either an economy of scale in the household or another non-linearity in the relationship between household size and consumption.

Finally, I add a measure of the amount of work the child has within the household. I test
four different measures, including the number of hours the adolescent female works in the home, two dummy variables to indicate the presence of an ill or chronically ill elderly woman in the house, and a variable to represent the elderly woman’s ADL index.

I estimate a child’s anthropomorphic z-score using the following specification:

\[ Z_{ij} = \alpha + \beta w_{ij} + \phi X_{ij} + \lambda T_{ij} + \varepsilon_{ij} \] (4)

which is a regression of anthropomorphic z-score for adolescent \( i \) in household \( j \) against the work of the child in the household \( (w_{ij}) \), a series of individual controls, a series of demographic controls \( (X_{ij}) \), a series of individual controls \( (T_{ij}) \), and a random error term \( (\varepsilon_{ij}) \). The same specification is used to test short-run and long-run effects. Coefficients are estimated using the ordinary least squares (OLS) method, and results are presented in section 5.
4 Data and Descriptive Statistics

This section describes the data used in this research. It also provides simple sample statistics of the individuals and households under study. The data suggest hypotheses that are investigated in subsequent sections.

Kagera is located in the northwest corner of Tanzania and borders Lake Victoria, Rwanda, Burundi, and Uganda. Kagera is predominately rural and dependent on coffee exports and agricultural produce, especially bananas. Kagera’s population has grown from 1.3 million in 1988 to approximately 2 million in 2004. Mean income in the region is near the national average, making it an ideal community in which to collect data for development projects and research (Kathleen Beegle (2006).) The data used in this analysis, collected by the World Bank in the Living Standards and Measurements (LSMS) project, come from a longitudinal household survey designed to measure poverty in developing countries using standardized household surveys.

The Kagera Health and Development Survey (KHDS) has two parts: a panel dataset with four rounds conducted from September 1991 to January 1994 (KHDS-1) and a re-interview in 2004 (KHDS-2.) The entire survey includes a household questionnaire and three community questionnaires (community, price, and primary schools.)

KHDS-1 is a household survey, but taken together KHDS-1 and KHDS-2 comprise a longitudinal survey. 912 households were interviewed during KHDS-1. Excluding households in which all members died, the KHDS-2 contacted and re-interviewed a member of 832 of the 912 original households. Since the field team attempted to track down and interview each member of an original KHDS-1 household, the KHDS-2 panel includes respondents from 2,774 households (Kathleen Beegle (2006).)

KHDS-1 used a cluster sampling design with two levels of stratification: agronomic zones for the first and adult mortality for the second. The four agronomic zones were: tree crop zone, riverine zone, annual crop zone, and urban zone. The zone labels are more suggestive than definitive but do ensure a cross-section of the ways Kagera residents earn their living.
The second stratification was based on the household’s perceived risk of an adult death, when “high” sampling units had mortality rates at or above the 90th percentile in comparison to all other sampling units (Kathleen Beegle (2006).) Adult mortality in the KHDS-1 survey was approximately 18 percent, nearly twice as high as in the general population. High HIV prevalence has been cited as the main explanatory factor by other studies (e.g. Ksoll (2007) and by the World Bank.)

One point about the cluster design deserves special note: Angus Deaton (1997) cautioned that observations within clusters tended to be more highly correlated than observations from different clusters. Since households were randomly chosen, observations from households in the same cluster may not be independent. Non-independent observations will not bias coefficient estimates, but they will artificially shrink standard errors. To account for the possibility of correlation within clusters, I report robust standard errors that take into account the possible dependency and are calculated under i.i.d. assumptions.

The KHDS survey asks about all permanent residents of a household, which it defines as individuals who had slept in the house for the majority of the previous month and expected to continue sleeping there for the next six months. It also collected information about “non co-resident children,” or children living elsewhere.

4.1 Elderly Women, Young Children, and Household Labor Shares in Kagera

The primary focus of this study is the short- and long-run impact of an elderly woman on young females in a household. In brief, earlier research investigated short-run changes to girl’s welfare that followed cash transfers targeted at elderly women. This paper studies the relationship between women’s status and girls’ outcomes in the absence of a policy intervention.

This paper’s primary results are based on analysis of the relationship between the hours of household work reported weekly by an elderly female in the household and the hours
of weekly household work reported by adolescent children. The sample of households was obtained by pooling data on households over all four years of the first survey. I restrict the sample to elderly females age 55 and over and girls between ages 5 and 13. This yields a relatively homogeneous sample as required for an analysis of the determinants of hours of work. I use the second panel of the survey to investigate the long-term outcomes of the girls and boys who lived with elderly females.

Hours spent performing household chores are of interest to this study. Subsequent tables show that young females spend a high proportion of their day working in the home. Earlier research, supported by this study’s preliminary statistical analysis, suggests young girls work in the home while attending primary school, rather than substituting work for school. This study touches on that hypotheses in its later stages.

Potentially more important is if the way household members spend their days reveals underlying dynamics of the household. Understanding who does what type of work and when—and what happens if that person is not able to complete his or her standard share—would improve our grasp of within-household dynamics. Armed with a better understanding of how a poor household in a developing country responds to adverse shocks, policy makers can re-think targeted interventions and development initiatives to better reflect how households operate during times of crisis.

For the purposes of this study, contributions by household members are estimated using several questions about the allocation of household chores. I include four different tasks in the “household chores” category: cooking and cleaning within the household, caring for other household members, collecting firewood, and gathering water. I include servants (makubaliano) in the calculation of total household hours but make no adjustment for those households that do employ servants from those who do not. The reason for this decision is the scarcity of servants within a household; only two of the 84 households report servants as household members.

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4 The data preclude the possibility of analyzing the economic relationship between family members in a household, e.g. between grandmothers and grandchildren, because there is insufficient data on the types of relationships between household members.

5 The reason for this decision is the scarcity of servants within a household; only two of the 84 households report servants as household members.

32
hold chores for each individual and for every individual within the household. An individual’s share of household work is defined as the percentage of total hours spent on household chores, or the hours they spend divided by the hours everyone spends.

![Diagram](image)

**Figure 1:** Average share of household labor performed by adolescent females living in households with and without elderly females (sample size: 316)

The impact of elderly women on young girls depends on whether they affect children’s share of household work, independent of household size. Household size is used to proxy for the amount of work in the home and the availability of others to complete it. The data show a strong correlation (0.4075) between household size and the total hours of work spent in the home. It is conceivable that a young girl in a larger household spends less time working in the home than one in a smaller household, all else held constant. More people in the household may create more chores, but they likely do so in a less-than-linear fashion; that is, they bring on less than “one-person’s worth” of chores. With more people in the household,
other people share the responsibility to complete chores as well. The Kagera data show this pattern as well.6

Figure 1 plots the percentage of household chores completed by adolescent females in households of different sizes. Each dot represents the mean fraction of hours worked by an adolescent female living without an elderly woman, while each bar represents the mean fraction of hours worked by an adolescent female living with an elderly woman. The averages fluctuate between 0 and 0.4 for girls living without elderly females and between 0 and 0.82 for girls living with elderly females. The greater variance of the latter group is likely a result of the smaller sample size. It appears that adolescent females living with elderly females take on a larger share of the household chores than adolescent females living without elderly females. Subsequent sections of this paper are devoted to exploring the degree and ramifications of this difference.

Figure 2: Average share of household labor performed by adolescent males living in households with and without elderly females (sample size: 359)

6Specific results are not reported due to space constraints. For further information, please contact the author.
Figure 2 plots the percentage of household chores completed by adolescent males in households of different sizes. Each dot represents the mean fraction of hours worked by an adolescent male living without an elderly woman, while each bar represents the mean fraction of hours worked by an adolescent male living with an elderly woman. The averages fluctuate between 0 and 0.3 for boys living without elderly females and between 0 and 0.8 for boys living with elderly females. The greater variance of the latter group is likely a result of the smaller sample size. It appears that adolescent males living with elderly females do not take on a larger share of the household chores than adolescent males living without elderly females. Taken together, Figures 1 and 2 imply differences in the effect of an elderly woman on male children and female children.

Other measurements and control variables are taken directly from survey questions. Among all regressions, I include the ages of the elderly woman and the adolescent girl, expecting older women to contribute less to household chores, more to household medical expenditures, and report worse measures of overall health. Household size is included, though the predicted sign is ambiguous. In aggregate, more time will be spent on chores in larger households; however, larger households may also exhibit economies of scale, in which the need for specific types of work (e.g. time spent preparing meals or gathering firewood) does not increase in a direct relationship with the number of household members. In addition, larger households can distribute tasks between more members. The natural log of household income is included to signal the household’s economic status. The sign of the coefficient on household income is also ambiguous. While wealthier households may be less likely to task younger females with household chores, rising income may also imply greater participation in the wage sector by household members, leaving household work to non-wage earners (e.g. young females and/or elderly females.)

If girls spend many hours per week working in the home, they may forgo some or all of their primary school education. The average age at which the adolescent females in my restricted sample started school was 8.84 years, implying girls in this study are likely to be
both working and attending some school. However, I expect the girl’s age to be an incomplete measure of her skills. To start, there is insufficient data on school attendance, and I expect heterogeneity in primary school quality within the sample. In addition, simple school enrollment measurements do not capture the frequency of children’s school attendance. Instead, I use the ability to perform basic skills, or their ability to read, write, and perform basic arithmetic, that are learned early in primary school (if not at home) as a better measurement for education level.

<table>
<thead>
<tr>
<th align="center">TABLE 1</th>
<th align="left">DESCRIPTIVE STATISTICS ON SAMPLE HOUSEHOLDS WITH WOMEN AND GIRLS</th>
</tr>
</thead>
<tbody>
<tr>
<td align="center"><strong>A. INDIVIDUAL CHARACTERISTICS</strong></td>
<td align="left"></td>
</tr>
<tr>
<td align="center">Elder woman</td>
<td align="left">Adolescent female (aged 5-13)</td>
</tr>
<tr>
<td align="center">Mean age</td>
<td align="left">67.5 (1.02)</td>
</tr>
<tr>
<td align="center">Mean hours per week of household work</td>
<td align="left">17.50 (2.08)</td>
</tr>
<tr>
<td align="center">Percent of total household work completed</td>
<td align="left">17.53% (1.62)</td>
</tr>
<tr>
<td align="center">Percentage of time gathering firewood</td>
<td align="left">5.90% (1.44)</td>
</tr>
<tr>
<td align="center">Percentage collecting water</td>
<td align="left">2.13% (.068)</td>
</tr>
<tr>
<td align="center">Percentage caring for others</td>
<td align="left">11.19% (2.93)</td>
</tr>
<tr>
<td align="center">Percentage cooking and cleaning</td>
<td align="left">17.52% (1.61)</td>
</tr>
<tr>
<td align="center"><strong>B. HOUSEHOLD CHARACTERISTICS</strong></td>
<td align="left"></td>
</tr>
<tr>
<td align="center">Mean</td>
<td align="left">Standard Deviation</td>
</tr>
<tr>
<td align="center">Household size</td>
<td align="left">9.44</td>
</tr>
<tr>
<td align="center">Number of elderly women</td>
<td align="left">1.10</td>
</tr>
<tr>
<td align="center">Number of females aged 14-18</td>
<td align="left">0.54</td>
</tr>
<tr>
<td align="center">Number of females aged 5-13</td>
<td align="left">1.43</td>
</tr>
<tr>
<td align="center">Number of females aged 0-5</td>
<td align="left">0.05</td>
</tr>
<tr>
<td align="center">Number of males aged 14-18</td>
<td align="left">0.58</td>
</tr>
<tr>
<td align="center">Number of males aged 5-13</td>
<td align="left">0.86</td>
</tr>
<tr>
<td align="center">Number of males aged 0-5</td>
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</tr>
<tr>
<td align="center">Hours devoted to household chores</td>
<td align="left">95.64</td>
</tr>
<tr>
<td align="center">Household income (TzS)</td>
<td align="left">154,924.70</td>
</tr>
<tr>
<td align="center">Expenditure on medical supplies (TzS)</td>
<td align="left">901.31</td>
</tr>
</tbody>
</table>

**Note:** These statistics pertain to the sample of 80 households obtained by pooling data on the cross section of households over the three survey years. Characteristics of elder women and adolescent girls are based on individual data on the two groups. Figures in parentheses are standard deviations.

Table 1 provides a demographic and economic profile of the sample of 84 households with elderly females and adolescent females. The average family size is approximately 9.44
members with 1.1 elderly females. The table also provides details on division of household labor among family members. As discussed above, household work is defined as the sum of the hours spent cooking, cleaning, caring for other household members, and gathering firewood and water. 77 percent of households report that elderly females work in the home, while 46 percent of households report adolescent females work in the home. The elderly females perform, on average, 17.5 percent of the total hours spent working in the home, while the adolescent females perform, on average, 15.3 percent of those hours.

<table>
<thead>
<tr>
<th>TABLE 2</th>
<th>Descriptive Statistics on Sample Households without Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A. Individual Characteristics</td>
</tr>
<tr>
<td></td>
<td>Mean age</td>
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<tr>
<td></td>
<td>Mean hours per week of household work</td>
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<td></td>
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<td></td>
<td>Percentage caring for others</td>
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<tr>
<td></td>
<td>Percentage cooking and cleaning</td>
</tr>
<tr>
<td>B. Household Characteristics</td>
<td>Mean</td>
</tr>
<tr>
<td>Household size</td>
<td>7.55</td>
</tr>
<tr>
<td>Number of elderly women</td>
<td>1.05</td>
</tr>
<tr>
<td>Number of females aged 14-18</td>
<td>0.42</td>
</tr>
<tr>
<td>Number of females aged 0-5</td>
<td>0.04</td>
</tr>
<tr>
<td>Number of males aged 14-18</td>
<td>0.42</td>
</tr>
<tr>
<td>Number of males aged 5-13</td>
<td>0.47</td>
</tr>
<tr>
<td>Number of males aged 0-5</td>
<td>0.031</td>
</tr>
<tr>
<td>Hours devoted to household chores</td>
<td>67.1845</td>
</tr>
<tr>
<td>Household income (TzS)</td>
<td>175,397.20</td>
</tr>
<tr>
<td>Expenditure on medical supplies (TzS)</td>
<td>250.86</td>
</tr>
</tbody>
</table>

Note: These statistics pertain to the sample of 129 households that contained an elderly woman but not an adolescent female and the 209 households that contain an elderly woman. The sample was obtained by pooling data on the cross section of households over the three survey years. Characteristics of elder women are based on individual data. Figures in parentheses are standard deviations.

The leftmost column of Table 2 provides a demographic and economic profile of the sample of 129 households with elderly females but without adolescent females and the total
sample of 204 households with elderly females. For those households with elderly women, average household size is 6.54 with 1.05 elderly females. Table 2 also provides details on division of household labor among family members. Household work is defined as it had been previously. All households with elderly females report positive working hours for those women in the home. The rightmost column of Table 2 reports the sample statistics for every household surveyed in KHDS-1.

4.2 Elderly Women’s Health in Kagera

The key to the second part of my analysis is the unusually good measures of the health status of household members provided by the KHDS data. In this section, I explore the effects of two types of health measures: self-reported illness symptoms and limitations in the physical ability to perform activities of daily living (ADLs.) Self-reported illness and diagnoses are similar to measures used by earlier literature. The presence of an illness is measured by a dummy variable for whether the individual reports any symptom (ill), and a dummy for whether they report a symptom that has lasted more than one month (chronically ill, or chronic.)

Earlier papers have identified important shortcomings in relying on self-reported symptoms to measure illness and health. First, few self-evaluations are standardized, and different definitions of one’s illness are likely to introduce measurement error. There is some evidence that wealthier and more educated individuals have looser definitions of “illness” and may be more likely to report experiencing an illness in the past month. (See Gertler and Gruber (2002), Thomas and Strauss (1992), and Schultz and Tansel (1997) for more.) Second, it is unlikely that all self-reported illness symptoms affect the work performed by elder females in the household. For example, one might expect hearing loss to affect an elderly female’s ability to care for other relatives but not her ability to prepare meals. Similarly, muscle pains may leave her unable to gather firewood, but she may still be able to care for others. Third, in separate studies, both John Bound (1991) and Thomas and Strauss (1997) noted that using
self-reported symptoms may overstate the effect of health status on labor supply because individuals who have already exited the labor force may justify their decision by over-stating a deterioration in health. Although this paper discusses the informal labor sector, the concern raised by Bound, Struass, and Thomas is relevant. Most notably, elder females may justify their reluctance to perform household chores because of health deterioration and/or old age.

Given the potential problems with self-reported health measurements, I use an additional variable to measure health. This variable approximates an individual’s physical ability to perform activities of daily living, or ADLs. Several physical functioning measurements are taken and based on individuals’ ability to engage in specific activities. Intermediate ADLs measure the ability to perform self-described vigorous activities, walk uphill, and walk 100 yards or more, while basic ADLs concern the ability to perform self-described moderate activities, bend over, eat, and walk less than 100 yards. A limitation in any of these activities, particularly a basic ADL, signals poorer health. For this study, I merged the two categories of ADLs, using a system of weights to maintain the original depth. Nearly half of all elderly females reported another sort of physical disability, including poor eyesight, poor hearing, a missing limb, or paralysis. I approximated additional physical detriment relating to these self-reported disabilities and added that to the ADL measurement to create a more robust measurement of health.

The responses to these questions in the survey are coded as: the activity poses no problem for the respondent (0), some problem (1), or a large problem (2). These responses are summed according to the algorithm specified by the RAND Medical Outcome Study (Stewart et al. (1990)) and employed elsewhere in the development economics literature (Gertler and Gruber (2002)):

\[
\text{Health} = \frac{\text{Score} - \text{Min Score}}{\text{Max Score} - \text{Min Score}}
\]

The Health Index takes on a value of zero if the individual can perform all ADLs without difficulty and reports no other limitation, and one if the individual cannot perform any ADLs.
and reports other significant limitations. This Health Index is a continuous measurement. I expect negative coefficients on the Health Index variable for all regressions, implying that poorer health restricts labor supply. I expect these results to be robust to various control variables and alternative specifications.

| TABLE 3 | DESCRIPTIVE STATISTICS ON ELDERLY WOMEN’S HEALTH |
|-----------------|---------------------------------|-----------------|
| | Elderly women with adolescent girls | Elderly women without adolescent girls | All elderly women |
| Percent reporting illness | 56.25% (5.58) | 63.57% (4.25) | 60.76% (3.38) |
| Percent reporting chronic illness | 76.25% (5.96) | 68.89% (4.64) | 71.77% (3.66) |
| Mean ADL | 0.46 (0.03) | 0.50 (.028) | 0.48 (.021) |

Note: These statistics pertain to the sample of 80 elderly women living with at least one adolescent female, the sample of 129 elderly women living without an adolescent female, and the total sample of 209 elderly women, respectively. Health characteristics of elder women are based on individual data. Figures in parentheses are standard deviations. Welch’s t-test does not show a statistically-significant difference between the means of any pair of the three populations for any of the three statistics.

The means and standard deviations of health outcome measurements for the elderly women are presented in Table 3. The first column reports means for elderly women who live with adolescent girls, while the second column reports means for elderly women living without adolescent girls. Over half of the elderly females reported suffering from an illness lasting less than one month or a chronic illness with symptoms persisting more than six months. Illness appears common, which indicates both measures may be picking up minor health problems that may not severely limit an elderly female’s ability to help out around the home. While collecting firewood or fetching water may be physically arduous tasks, providing care or support may not be. As a result, it is not surprising to see differences in the type of work performed by people who report the same illness level. The correlation between the measures for self-reported short-term and chronic illness is high (0.38), but I do not investigate the potential for a causal relationship between short-term and chronic illness; as discussed above, self-evaluations are prone to measurement error, and the high correlation may, in part, result from erroneous recollections of a symptom’s start date and/or duration. However, nearly all elderly females reported some health limitation, and just under
three-quarters reported an Health Index score of 0.30, implying the average elderly female is impaired in some way—an unsurprising result, given this study’s context (rural communities in a developing country) and its definitions (some impairment is to be expected with age.)

Comparing columns one and two of Table 3 suggest there is no significant difference in the health status of elderly women living with and without adolescent females. Welch’s $t$-test, which tests the null hypothesis that the means of two normally-distributed populations are equal given unequal (but unknown) population variances, confirms this. None of the three text statistics can be rejected at the 5% significance level. The $t$-statistics are $1.0425 (163.4)$, $-0.9005 (81.5)$, and $0.7413 (179.0)$, for short-term illness, chronic illness, and mean ADL respectively, with Satterthwaite’s degrees of freedom calculation reported in parentheses. Although the relevant table is not shown, no significant difference can be found in the health status of elderly women living with and without adolescent males.

Maintaining the null hypothesis of no difference in means for Welch’s $t$-test implies there are neither systematic differences between the health of elderly women living with adolescent females and those living without them, nor systematic differences between those elderly women living with adolescent males and those living without them. If the presence of an adolescent female is not correlated with an elderly female’s health, and if elderly females of a certain health status are no more likely to live with an adolescent of either sex than without one, it is unlikely the coefficient estimates of the effect of health on an adolescent’s labor hours are biased by a selection effect. The relevant regressions and coefficient estimates are the subject of this paper’s next section.
5 Results

The summary statistics in the previous section reveal that young females living in households with elderly females perform more work in the household, on average, than young females living in households without elderly females. They also show no significant difference between the elderly women living with adolescent females and those living without them. Neither set of statistics prove the presence of an elderly women leads to more household labor by female children; nor do they show any causal relationship between an elder women’s health and work preformed by adolescents. However, regression analysis that controls for other household variables affecting household labor and health can assess whether elderly women’s health motivates increasing shares of girl’s labor.

Regressions presented in this section estimate the effect of elderly women’s health on younger girls’ work share at home and explores their sensitivity to alternative control variables and measurements of health. Most regressions reveal a significant negative effect of elderly women’s declining health on female children’s household labor shares, a result suggesting both that households must cope with an elderly female’s illness and that adolescent females are disproportionately affected. However, these effects seem to be smoothed out in the long run, as there is no apparent difference between girls who grew up with elderly women and those who grew up without them in the KHDS-2 data. In addition, no similar, significant effect is found for male adolescents. Exploring the causes and ramifications of this one-sided effect is the primary purpose of the subsequent sections of this paper.

5.1 Does Health Status Affect Household Labor Shares?

OLS Results

I use Equation (1) from Section 3.1 to estimate an elderly woman’s labor supply in the household, contingent on her health. Table 4 reports three OLS regressions using the three measurements of health ($h_{ij}$) previously discussed: as a binary variable for illness
symptoms experienced during the past thirty days (*ill*), a binary variable for illness symptoms experienced during the past 180 days (*chronic*), and using the ADL Index. The coefficients attached to both short-term illness symptoms (Regression 1) and the ADL index (Regression 3) are significant at the one percent level. The coefficient for chronic illness symptoms (Regression 2) is not significant at the ten percent level. Household labor share is measured as the hours worked per week by one person divided by the hours worked per week by everyone in the household.

**TABLE 4**

REGRESSIONS OF ELDERLY WOMEN’S WORK HOURS ON HER HEALTH STATUS

<table>
<thead>
<tr>
<th></th>
<th>Regression 1</th>
<th>Regression 2</th>
<th>Regression 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old woman’s age</td>
<td>0.0177</td>
<td>0.0152</td>
<td>0.0222</td>
</tr>
<tr>
<td></td>
<td>(0.018)</td>
<td>(0.020)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>Old woman’s age^2/100</td>
<td>-0.0152</td>
<td>-0.0132</td>
<td>-0.0179</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.014)</td>
<td>(0.013)</td>
</tr>
<tr>
<td>Old woman married (=1)</td>
<td>0.115***</td>
<td>0.117***</td>
<td>0.109***</td>
</tr>
<tr>
<td></td>
<td>(0.032)</td>
<td>(0.033)</td>
<td>(0.032)</td>
</tr>
<tr>
<td>Log(household income)</td>
<td>-0.0188</td>
<td>-0.0170</td>
<td>-0.0172</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.017)</td>
<td>(0.016)</td>
</tr>
<tr>
<td>Household size</td>
<td>-0.00928***</td>
<td>-0.00924***</td>
<td>-0.00866**</td>
</tr>
<tr>
<td></td>
<td>(0.0032)</td>
<td>(0.0033)</td>
<td>(0.0035)</td>
</tr>
<tr>
<td>Illness symptoms in past 1 month (=1)</td>
<td>-0.0714***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.026)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic illness symptoms in past 6 months (=1)</td>
<td></td>
<td>-0.0189</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.026)</td>
<td></td>
</tr>
<tr>
<td>ADL</td>
<td></td>
<td></td>
<td>-0.120***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.042)</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.00156</td>
<td>0.0327</td>
<td>-0.184</td>
</tr>
<tr>
<td></td>
<td>(0.64)</td>
<td>(0.70)</td>
<td>(0.65)</td>
</tr>
<tr>
<td>Observations</td>
<td>74</td>
<td>74</td>
<td>74</td>
</tr>
<tr>
<td>R^2</td>
<td>0.42</td>
<td>0.36</td>
<td>0.41</td>
</tr>
</tbody>
</table>

**Note:** All regressions were estimated by OLS. Figures in parentheses are robust standard errors. The F-statistics, which test the explanatory power of the regressions, are F(6,67) = 11.08 (p = 0.0000) F(6,67) = 8.29 (p = 0.0000) and F(6,67) = 11.89 (p = 0.0000) for Regressions 1, 2, and 3, respectively. Significant levels are reported as: *** p<0.01, ** p<0.05, * p<0.1

According to Regression (1), having recently experienced illness symptoms reduces the share of work in the home performed by the elderly women by 7.85 percent, which is approximately 7.50 hours per week on average. The coefficient on the measurement of health
in Regression 2, experiencing symptoms of chronic illness in the previous six months, is not significant at the 10 percent level. This is unsurprising if households are able to adjust to changes in health status over time. For example, households may compensate for chronic illness by shifting household tasks from chronically-ill members toward healthier members. The results of Regression 2 in Table 4 suggest households are able to adjust to chronic illness. Furthermore, the non-effect of chronic illness on the percentage of household chores completed per week does not trouble the results presented in subsequent sections of this paper. In Regression 3, illness is represented by an increase in the ADL, so that a negative coefficient indicates that illness reduces labor share. There is a sizeable and significant effect for changes to the ADL measurement. The coefficient predicts a 13.1 percent decline in share of household labor, or 12.53 hours per week on average, if the woman moves from entirely healthy (ADL = 0) to entirely ill (ADL = 1). The control variables are generally insignificant, except that married women are likely to take on a larger proportion of the household labor and adding members to the household has a negative and significant effect on the elderly women’s labor share.

5.2 Does Health Status Affect Household Medical Expenditure?

OLS Results

There are other costs of poor health beside the reduction in labor supply. I use Equation (2) from Section 3.2 to estimate the effect of the elderly woman’s health status on household medical expenditure.

Regression results, quantifying a partial cost of illness to the household in terms of increased medical spending, are presented in Table 5. As above, three regressions using different measurements of poor health are presented. Regressions (1) and (2) attempt to quantify the effect of poor health using the two binary variables for illness symptoms. The overall regression $F$-statistic tests the joint hypothesis that all regression coefficients are zero. I cannot reject the null hypothesis that *none* of the regressors explains any of the variation in med-
Grandmothers and Granddaughters Revisited

Cacioppo

medical expenditure at the five percent level for either Regression (1) or Regression (2). This is not necessarily troubling, as poor households may be reluctant to respond to the onset of recent symptoms, given their resource constraints, and may instead hold out until conditions may improve. It is also unlikely poorer households will be able to adjust quickly their joint consumption and re-allocate income toward more of a certain good (e.g. medicines.)

| TABLE 5 | REgressions of Household Medical Expenditure on Elderly Women’s Health |
|---|---|---|
| Regression 1 | Regression 2 | Regression 3 |
| Grandmother’s age | 16.90 | 83.16 | -66.59 |
| (233) | (264) | (258) |
| Grandmother’s age$^2$/100 | -27.19 | -80.15 | 23.09 |
| (171) | (197) | (190) |
| Old Woman Married (=1) | -472.0 | -530.9 | -362.7 |
| (533) | (554) | (481) |
| Log(household income) | -174.2 | -205.4 | -197.5 |
| (190) | (186) | (194) |
| Household size | 87.18* | 93.92* | 77.11 |
| (50.7) | (55.3) | (63.6) |
| Illness symptoms in past 1 month (=1) | 1080** | | |
| (496) | | |
| Chronic illness symptoms in past 6 months (=1) | | 805.5* | |
| | | (441) | |
| ADL | | 2123* | |
| | | (1144) | |
| Constant | 1734 | 49.37 | 4946 |
| (7980) | (9001) | (9050) |
| Observations | 74 | 74 | 74 |
| $R^2$ | 0.08 | 0.06 | 0.09 |

Note: All regressions were estimated by OLS. Figures in parentheses are robust standard errors. The F-statistics, which test the explanatory power of the regressions, are $F(6,67) = 1.25$ ($p = 0.2932$) $F(6,67) = 0.95$ ($p = 0.4651$) and $F(6,67) = 0.79$ ($p = 0.5788$) for Regressions 1, 2, and 3, respectively. Significance levels are reported as: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

However, using the ADL measurement to approximate health declines results in a significant increase in monthly medical expenditure. The result, presented in Regression (3) is robust to the inclusion of other control variables, including household income and size. A total decline in the Health Index, or a move from completely healthy (ADL = 0) to completely unhealthy (ADL = 1) leads to an increase in monthly medical expenditure by 2,532.
TzS, which nearly triples mean medical expenditure per household. Household size has a positive effect on medical expenditure: with every additional person in the household, medical expenditure is expected to increase by 553.60 TzS per month, over half of the mean expenditure. The positive coefficient on household size suggests economies of scale do not exist in a household’s medical expenditure, which is unsurprising; medicines, physician visits, and primary care are all examples of household private goods that cannot be easily shared between members of the same household.

The results of Regression (3) in Table 4 and Regression (3) in Table 5 suggest an elderly woman’s declining health costs her household a great deal in financial and non-financial terms. From Regression (3) in Table 4, we see that an elderly female performs a smaller proportion of the household work when she falls ill or her health declines. From Regression (3) in Table 5, we see that her household is likely to increase its overall spending on medical supplies. With the costs of declining health established, the remainder of this section will explain the disproportionate ramifications of these costs on adolescent females.

5.3 Do the Health Declines in Elderly Females Affect Young Children in the Short and Long Run? OLS and IV Results

I use Equation (3) from Section 3.3 to estimate the effect of the elderly woman’s health status on the share of work performed by an adolescent. OLS regression results are presented in Regression (1) of Table 6. I find a significant and negative relationship between the shares of work preformed by the elderly woman and the young girl, but the result may be biased and inconsistent. The explanatory variable, the share of household chores preformed by the elderly woman, may be endogenous. If elderly women and young girls both respond to some unobserved factor when deciding how many hours they will spend on household chores or which tasks they will complete, and this factor is not included in Equation (4) above, the coefficient estimate $\beta$ will be biased.

To correct for endogeneity of the explanatory variable, I use Equation (3) in four instru-
mental variables regressions. Instruments for Regressions (2) - (5) are respectively: a binary measure of recent illness, a binary measure of chronic illness, the woman’s ADL, and all three measures at once. IV regression results are presented in Regressions (2) - (5) of Table 6. As before, the labor share of the elderly women is a continuous variable that takes values from zero to one, inclusive. Regression (1) uses OLS and the share of household labor the elderly woman reports to estimate the adolescent girl’s household labor share, while Regressions (2) - (5) predict the girl’s labor share using IV and a set of characteristics of the elderly woman, including a measure of her overall health status.

Only the regression using the first instrument set that includes a dummy variable for recent illness has a statistically-significant F-statistic. In an instrumental variable regression, the F-statistic indicates the correlation between the endogenous variable and the instrument. The insignificance of the overall-regression F-statistics for Regressions (3), (4), and (5) suggest that the elderly women’s labor share is not strongly correlated with a dummy for whether the woman suffers from a chronic illness or with an overall measure of her health. These conclusions do not trouble the main result of this paper: that overall health affects labor shares, and that declines in health are detrimental at first but are later smoothed over by the household. The rest of this subsection is devoted to explaining the regression results presented in Table 6.

Regression (1) predicts a 2.86 percent increase in the time the young girl spends on household work for every ten percent less of work the old woman performs. The results imply that for every 9.6 less the woman works per week, the girl works 2.9 hours more, on average. However, I am worried those coefficient estimates might be biased for the reasons discussed above.

Regression (2) is estimated by instrumenting the elderly woman’s work share controlling for her age, her age squared, and her marital status. The instrument is a dummy indicating a recently-contracted illness. The results predict a 6.52 percent increase in time spent on household work by the girl for every ten percent less of work performed by the elderly woman.
This translates to an increase of 6.3 hours by the girl for every 9.6 hours less by the woman, on average.

Of the control variables, the only one that is statistically significant is a control for household size. If there are economies of scale in household chores, it follows that an increase in the number of people in a household would result in a less-than proportionate increase in the time spent on housework. Using the logarithm of household size allows the model to capture some non-linearity in the relationship between household size and aggregate time spent on chores. None of the coefficients on the other control variables are significant at the 10 percent level.

<table>
<thead>
<tr>
<th>Instrument used</th>
<th>Regression 1</th>
<th>Regression 2</th>
<th>Regression 3</th>
<th>Regression 4</th>
<th>Regression 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Regression 1</td>
<td>Regression 2</td>
<td>Regression 3</td>
<td>Regression 4</td>
<td>Regression 5</td>
</tr>
<tr>
<td>Girl’s age</td>
<td>0.00697</td>
<td>0.00336</td>
<td>-0.00377</td>
<td>0.0138</td>
<td>0.0100</td>
</tr>
<tr>
<td></td>
<td>(0.0081)</td>
<td>(0.010)</td>
<td>(0.022)</td>
<td>(0.0092)</td>
<td>(0.0082)</td>
</tr>
<tr>
<td>Able to perform arithmetic (=1)</td>
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<td>-0.0481</td>
<td>-0.0989</td>
<td>0.0259</td>
<td>-0.000707</td>
</tr>
<tr>
<td></td>
<td>(0.039)</td>
<td>(0.049)</td>
<td>(0.12)</td>
<td>(0.043)</td>
<td>(0.039)</td>
</tr>
<tr>
<td>Kms to nearest primary school</td>
<td>0.00343</td>
<td>0.00746</td>
<td>0.0154</td>
<td>-0.00416</td>
<td>0.0000179</td>
</tr>
<tr>
<td></td>
<td>(0.014)</td>
<td>(0.017)</td>
<td>(0.030)</td>
<td>(0.015)</td>
<td>(0.013)</td>
</tr>
<tr>
<td>Log(household size)</td>
<td>-0.129***</td>
<td>-0.167***</td>
<td>-0.241</td>
<td>-0.0585</td>
<td>-0.0975**</td>
</tr>
<tr>
<td></td>
<td>(0.043)</td>
<td>(0.059)</td>
<td>(0.18)</td>
<td>(0.059)</td>
<td>(0.046)</td>
</tr>
<tr>
<td>Log(household income)</td>
<td>0.0115</td>
<td>0.00607</td>
<td>-0.00469</td>
<td>0.0218</td>
<td>0.0161</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.022)</td>
<td>(0.036)</td>
<td>(0.024)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>Elderly woman’s work share</td>
<td>-0.410***</td>
<td>-0.776*</td>
<td>-1.499</td>
<td>0.278</td>
<td>-0.101</td>
</tr>
<tr>
<td></td>
<td>(0.14)</td>
<td>(0.42)</td>
<td>(1.63)</td>
<td>(0.34)</td>
<td>(0.22)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.327</td>
<td>0.568</td>
<td>1.043</td>
<td>-0.126</td>
<td>0.123</td>
</tr>
<tr>
<td></td>
<td>(0.25)</td>
<td>(0.38)</td>
<td>(1.12)</td>
<td>(0.31)</td>
<td>(0.27)</td>
</tr>
<tr>
<td>Observations</td>
<td>74</td>
<td>74</td>
<td>74</td>
<td>74</td>
<td>74</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.18</td>
<td>0.10</td>
<td>.</td>
<td>.</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Note: Regression (1) is an OLS regression. Regressions (2) - (5) are instrumental variable regressions. The share of household labor performed by the elderly woman was instrumented using characteristics of the woman, including her health status, with the linear estimates presented in table 3. Figures in parentheses are robust standard errors. The $F$-statistics, which test the explanatory power of the regressions, are $F(6,67) = 3.42$ (p = 0.0053) $F(6,67) = 2.31$ (p = 0.0440) $F(6,67) = 1.12$ (p = 0.3591) $F(6,67) = 1.08$ (p = 0.3809) and $F(6,67) = 1.52$ (p = 0.1852) for Regressions 1, 2, 3, 4, and 5 respectively. Significance levels are reported as: *** p<0.01, ** p<0.05, * p<0.1.
The results of Regressions (1) and (2) imply girls spend less time on household chores than elderly women had. What happens to the difference between the work completed by the girl and the work not completed by the woman? It is a difficult question to answer, primarily because there is insufficient data to test whether some members are able to complete household chores faster than others. One explanation, seemingly reasonable but difficult to test, is that it takes young girls significantly less time to complete a specific task than it takes elderly women to complete the same task.

While extreme, it is possible the young girl takes on all of the chores of the elderly woman but is able to complete them in less time. If true, this implies preforming household chores does not lead to the accumulation of job-specific human capital, or at least not capital independent of physical condition. As discussed above, it is likely there are declining returns to age and health for the more labor-intensive chores, like gathering firewood and fetching water. Unfortunately, this study does not have sufficiently-detailed data to separate out the returns to time spent on specific chores for different age and experience levels. Future research could investigate questions about the accumulation of human capital in regard to household jobs in developing countries.

A final, potential explanation allows for the existence of job-specific capital but implies the skills need to preform household chores are obtained quickly. Perhaps the learning curve for preforming household chores is short and skewed toward the initial stage: it does not take much time to learn to collect firewood or cook for a family, and most of the learning for girls takes place at a very young age. By the time the task becomes one of their primary responsibilities in the household, they are already able to perform it well. Without better data on when children started performing certain types of work, it is difficult to test this explantation. However, it is a persuasive concept that lends itself to future research.
5.4 Do Changes in Family Members’ Health Affect Young Children in the Long Run? OLS Results

I use Equation (4) from Section 3.4 to estimate the effect of the elderly woman’s health on the child’s anthropomorphic measurements. OLS regression results are presented in Tables 7a and 7b for girls and boys respectively. As discussed above, three anthropomorphic outcomes are used: weight-for-height z-scores, height-for-age z-scores, and Body Mass Index. All z-scores comparisons are made to the average child in the Kagera data, conditioned on the child’s gender. The anthropomorphic measurements were taken in the last panel of KHDS-1, so they capture the immediate effect of the elderly woman’s health.

<table>
<thead>
<tr>
<th>TABLE 7a</th>
</tr>
</thead>
<tbody>
<tr>
<td>EFFECT OF ELDER WOMEN’S HEALTH ON ADOLESCENT GIRLS’ ANTHROPOMORPHIC INDICATORS</td>
</tr>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>Older woman recently ill</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Older woman chronically ill</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Older woman’s ADL</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Observations</td>
</tr>
</tbody>
</table>

Control variables

| Individual characteristics | Yes | Yes | Yes |
| Family background variables | Yes | Yes | Yes |

Note: Standard errors (robust to heteroscedasticity) are in parentheses. Specifics of the two control variable categories are discussed in section 4. Significance levels are reported as: *** p<0.01, ** p<0.05, * p<0.1

As shown in Table 7a, I find a negative relationship between whether the elderly woman is chronically ill and the girl’s weight-for-height measurement. Specifically, the regression results suggest that having a chronically-ill grandmother decreases a young girl’s weight-for-height measurement by one-third of a standard deviation. This effect is significant at the five percent level. No similar effect is found on the girl’s BMI, which is surprising given the similarities between the weight-for-height z-scores and BMI measurement. However, according to the results presented in Table 7a, a total decline in the elderly woman’s ADL
drops the girl’s BMI by over two points. This effect is significant at the five percent level. Yet the elderly woman’s ADL seems to have no effect on the young girl’s weight-for-height z-score, another puzzling result. The regression results do not provide convincing evidence that elderly women’s health affects young girls’ growth.

Regression results for the effect of an elderly woman’s health on adolescent boy’s anthropomorphic indicators are displayed in Table 7b. I find a positive effect on boys’ height-for-age measurements of having a recently-ill grandmother. The regression reports the effect — an increase in the standard deviation by one-third — is significant at the ten percent level, but I have reason to doubt the regression result’s validity. First, I expect any anthropomorphic effect of a decline in the elder woman’s health to be negative. The rationale behind this hypotheses is discussed above. Also discussed above, the height-for-age measurement is often viewed as a reflection of a stock of investment in a child’s welfare, rather than a measure sensitive to short-term changes in nutrition consumption or labor demands. With this in mind, the regression results do not suggest that an elderly woman’s health affects the young boy’s growth.

After finding the health of an elderly woman does not seem to affect the near-term growth of young boys or young girls, I test to see whether there are permanent effects on growth of
having an ill grandmother. I again use Equation (4) from Section 3.4 to estimate the effect of the elderly woman’s health on the child’s anthropomorphic measurements. However, this time I use the anthropomorphic measurements that were taken during KHDS-2, ten years after the woman was ill. OLS regression results are presented in Tables 8a and 8b for girls and boys respectively.

<table>
<thead>
<tr>
<th>Variable</th>
<th>BMI</th>
<th>Weight for height</th>
<th>Height for age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Older woman recently ill</td>
<td>-2.038</td>
<td>0.077</td>
<td>0.498</td>
</tr>
<tr>
<td></td>
<td>(2.59)</td>
<td>(0.27)</td>
<td>(0.44)</td>
</tr>
<tr>
<td>Older woman chronically ill</td>
<td>-2.878</td>
<td>-0.115</td>
<td>0.569</td>
</tr>
<tr>
<td></td>
<td>(3.33)</td>
<td>(0.29)</td>
<td>(0.59)</td>
</tr>
<tr>
<td>Older woman’s ADL</td>
<td>0.664</td>
<td>-0.303</td>
<td>0.176</td>
</tr>
<tr>
<td></td>
<td>(1.82)</td>
<td>(0.42)</td>
<td>(0.37)</td>
</tr>
<tr>
<td>Observations</td>
<td>49</td>
<td>49</td>
<td>49</td>
</tr>
</tbody>
</table>

Control variables

| Individual characteristics | Yes | Yes | Yes |
| Family background variables | Yes | Yes | Yes |

Note: Standard errors (robust to heteroscedasticity) are in parentheses. Specifics of the two control variable categories are discussed in section 4. Significance levels are reported as: *** p<0.01, ** p<0.05, * p<0.1

The regression results presented in Table 8a are not significant. I also use Equation (4) to estimate the effect on male children and did not find that elderly women’s health had a significant effect on long-run growth. Those results are shown in Table 8b. It appears the elderly woman’s health has no effect on long-run anthropomorphic measurements for girls or for boys.
<table>
<thead>
<tr>
<th>Variable</th>
<th>BMI</th>
<th>Weight for height</th>
<th>Height for age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Older woman recently ill</td>
<td>0.431</td>
<td>0.141</td>
<td>0.090</td>
</tr>
<tr>
<td></td>
<td>(0.37)</td>
<td>(0.14)</td>
<td>(0.16)</td>
</tr>
<tr>
<td>Older woman chronically ill</td>
<td>-0.209</td>
<td>0.108</td>
<td>0.154</td>
</tr>
<tr>
<td></td>
<td>(0.44)</td>
<td>(0.13)</td>
<td>(0.18)</td>
</tr>
<tr>
<td>Older woman’s ADL</td>
<td>-0.715</td>
<td>-0.105</td>
<td>-0.323</td>
</tr>
<tr>
<td></td>
<td>(0.62)</td>
<td>(0.22)</td>
<td>(0.25)</td>
</tr>
<tr>
<td>Observations</td>
<td>67</td>
<td>67</td>
<td>67</td>
</tr>
</tbody>
</table>

Control variables

| Individual characteristics   | Yes  | Yes              | Yes            |
| Family background variables  | Yes  | Yes              | Yes            |

Note: Standard errors (robust to heteroscedasticity) are in parentheses. Specifics of the two control variable categories are discussed in section 4. Significance levels are reported as: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

I also used Equation (4) to determine the effect of elderly women’s health on the age at which children started primary school, the years they spent in school, wages later in life, and mortality rates. No effects were found. Regression results are not shown. A primary limitation was the lack of detailed data on long-run education and wage outcomes; nothing is known, for example, about children’s school attendance or test scores. With better outcome data, an assessment of the effect of additional household work would be more convincing.

In sum, I find no effect of an increase in time spent on household work on various anthropomorphic and education outcomes of young children. It is likely there is a channel through which an increase in household workload affects long-run outcomes of young children; perhaps young females who have more experience working in the home are able to secure more desirable marriages. If true, that might also explain the reason girls pick up more work than boys when elderly women fall ill. Alternatively, more hours spent gathering firewood and cooking for the family may keep young girls out of primary school, thereby limiting their options in the future. Further research is required to understand the mechanisms behind these effects, as well as the mechanisms behind any others.
6 Conclusion

The goal of this paper is to determine whether or not illness of older women affects the workload of young children in rural Tanzanian households, and if so, to assess the short- and long-term effects on children’s health and education. The elderly, and especially elderly females, receive little attention in the development economics literature. As discussed previously, little is known about their responses to different incentives and general preferences, save for a handful of studies based on the South African Pension program. This paper investigates outcomes when elderly women are unable to fulfill their traditional role in households. It uses a newly-released longitudinal data set to answer questions about family dynamics and track outcomes over a ten-year period.

The most substantial contributions of this paper are adding to empirical knowledge about household labor and about gender differences within families. Based on my empirical findings, I argue that household members are intimately tied together; the effects of one person’s illness reverberate through the entire family. Although beyond the scope of this paper, the same is likely true for other types of economic shocks. This paper has also shown the effects of illness are likely to be unevenly distributed between members of the household. The analysis presented here suggests health shocks are a key factor that increases the household workload of young girls but not that of young boys.

The findings imply there are nontrivial, non-financial costs to the household when elderly women fall ill. The brunt of these costs are borne by younger females. The finding that young girls suffer disproportionately when older women fall ill has social and economic significance. Future health policy interventions may be better targeted at supporting older women, particularly those who complete a significant amount of the work within the household. By helping families insure themselves against the risk of an old woman’s illness, young girls may be protected from hardship as well. This logic is similar to that presented by Esther Duflo (2003) in her evaluation of the South African pension program.

Unfortunately, this study is unable to determine the complete, long-run impact of living
with an elderly woman, either sick or well, on young girls. This study was also unable to resolve the key issue of why some families include an elderly woman and others do not. To the extent the elderly woman’s presence is endogenous to household labor or children’s education outcomes, the results presented should be considered carefully. A larger sample size would have allowed the use of household fixed effects, which would eliminate the chance of omitted variables bias from excluded but unobservable family characteristics. Stronger instruments for chronic illness and overall health index may have improved the estimation of the effect of health declines on labor shares. Finally, a richer set of outcome measurements may have provided a more convincing case for the non-effect of household labor shares on child health and education.

Future research may examine whether and how young girls are protected from adverse consequences of increasing their labor shares in the household. Some family members, perhaps the women, may enter into implicit contracts designed to smooth consumption as best as possible. It would be interesting to examine if altruism is at play, perhaps by examining whether the grandmother concentrates a disproportionate share of her work for the granddaughter when she is well, prematurely compensating for the hardships the girl may suffer later. Or, altruism need not be an issue, especially if the young girl is saddled with a disproportionate amount of responsibility for the old woman. It would also be informative to determine other mechanisms through which household members cope with illness, as the young girls do not shoulder the entire burden.
7 References

References


_ , The White Man’s Burden: Why the West’s Efforts to Aid the Rest Have Done So Much Ill and So Little Good, Penguin Press HC, The, March 2006.


Thomas, Duncan, “Like Father, like Son; Like Mother, like Daughter: Parental Resources and Child Height,” The Journal of Human Resources, Autumn 1994, 29 (4), 950–988.


