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Gender and Intrahousehold Food Allocation in Southern Ethiopia

by

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Gender and Intrahousehold Food Allocation in Southern Ethiopia

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Summary

This paper examines the patterns of food allocation within Ethiopian households, with a particular focus on gender differences and the sources of these differences. Gender roles in Ensete-growing households in southern Ethiopia seem to be quite separate. The different roles assumed by males and females could affect intra-household food allocation in several ways. First, the household could allocate resources according to need, and need varies by the activities in which household members engage. Second, gender roles could affect the bargaining power of males and females within the household, thereby affecting the sharing rules.

Analyzing data on individual calorie intakes, we found little if any gender differences in the allocation of calories within the household, even after accounting for differential calorie requirements. We also failed to find a meaningful effect of potential wages on the allocation of food between adult males and females within the household. We did find, though, that the economic position of women has a positive effect on the food allocated to their children. Pregnant and breastfeeding women experienced inadequate calorie allocation, implying that such women were at higher risk of malnutrition. Children in poorer families tended to consume more calories relative to their parents. Adult female children consumed more calories than their male counterparts, while birth order had a positive effect on calorie consumption among the younger children. The number of children in the family had a negative effect on each child's calorie consumption, implying exploitation of children by other household members in families with more children.

These results suggest that policies involving fertility control and nutritional support for pregnant and breastfeeding women may reduce the exposure of vulnerable population groups in Southern Ethiopia to the risk of malnutrition.

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Introduction

Nutrition is an important ingredient of economic development. Adequate nutrition enhances physical health, thereby improves labor productivity. Good nutrition is also associated with learning ability, hence nutrition could lead to higher human capital accumulation (Schultz, 1997). Nutrition also increases life expectancy, which is known to be important for development (Cervellati and Uwe, 2002). The literature on health, nutrition and economic development has been surveyed by Behrman and Deolalikar (1988), and more recently by Strauss and Thomas (1998).

Undernutrition is among the main concerns of the Ethiopian people. 70% of children under five years of age suffer from Protein Energy Malnutrition (de Onis et al., 1993). Deficiencies of other micronutrients are prevalent as well (Wolde-Gebriel, 1992). Various policy measures can be used to alleviate these problems. The effectiveness of policy measures crucially depends on the way households respond. In extreme cases the response to a program on the household level can completely neutralize the effect of the program (Doss, 1996, Haddad et al., 1992). Hence, understanding how decisions about resource allocation are made within households is crucial to the successful design of nutrition policies (Haddad, Hoddinott and Alderman, 1994).

Gender differences in general have been found to be a relevant issue in rural Ethiopia (Fafchamps and Quisumbing, 2003; Kimhi, 2004). Gender differences in nutritional intakes could be due to biological differences, but also to differences in nutritional requirements as a result of different physical activities. In addition, they could be affected by intrahousehold resource allocation processes (Bolin, Jacobsson, and Lindgren, 2001). While neoclassical economists modeled the household as maximizing a joint utility function, many recent studies provided evidence that rejects the neoclassical unitary model in favor of alternative models based on intrahousehold bargaining (e.g., Alderman et al., 1995). The implication of intrahousehold bargaining for food allocation is that the effect of extra income (or food) depends not only on its size but also on its source (Schultz, 1990). For example, Ghosh and Kanbur (2003) showed that in the presence of specialization of males and females in different activities, an increase in male wage could make females worse off.

This paper aims to shed light on the way by which social and economic factors affect the dynamics of within-household resource-allocation processes. We are especially interested in the conditions under which women are more likely to affect intrahousehold decision making. Numerous studies carried out in less developed countries indicate that although men provide the main source of income to the family, women take the direct and major responsibility for the allocation of food and other resources to children (and especially so in Africa - see Dwyer and Bruce 1988). Women's role in decision making is affected by their access to money resources and their own perception of themselves as decision makers. Differences in gender relations, especially women's power in decision making, lead to variations in intrahousehold bargaining processes which affect a wide range of decisions, including food allocation, especially among the poor. Thus, it is important to examine these processes especially in the context of poverty alleviation policies.

The specific goal of this paper is to study the determinants of nutritional intakes of different household members. Nutritional status can serve as a useful and easily-measured indicator of human welfare (The Transitional Government of Ethiopia, 1993). In particular, we will examine allocation patterns of calories within Ethiopian families, and test whether they are affected by indicators of bargaining power of different household members. The specific indicator we use is the potential wage. It is hypothesized that the bargaining power (or threat point) of each household member is affected by his/her potential wage. The bargaining approach predicts, specifically, that each member's share in household resources will rise with an increase in his/her potential wage, and decline with an increase in another member's potential wage. These behavioral patterns are not inconsistent with the unitary model. It could be that an increase in the potential wage of a household member will make this member work longer and have less leisure, and be compensated by an increased share of calorie consumption. This does not mean that actual consumption of other family members declines. Supposedly, they can all increase their consumption, but not as much as this member. It could also be that this member needs a higher calorie consumption just to compensate for the extra effort he makes while working longer hours, with no effect on welfare.

We try to neutralize this second effect in the following way. First, as in Senauer, Garcia, and Jacinto (1988), we do not use actual calorie consumption as a dependent variable, but rather use the Nutritional Adequacy Ratio (NAR), which is defined as actual calorie consumption divided by the Recommended Dietary Allowance (RDA), which is the amount of calories each person is "expected" to consume. By this we adjust calorie consumption to calorie requirements which depend on gender, age, and body weight.[1] Second, we allow the RDA to depend on physical activities, so that members who spend more time in physically-demanding activities are recognized by the household to be entitled to more calories. By this, we make it less likely that an increase in a member's share of calories is a pure compensation for his/her increased calorie expenditures.

We look separately at men, women, and children. Kebede (1990) has claimed that most decisions within Ethiopian households are taken by the male head of household. It is therefore especially interesting to look at the way that children's calorie consumption depends on their parents' potential wages. According to the unitary model, one could expect that differences between the effects of an increase in father's potential wage and an increase in mother's potential wage on children's consumption are not extremely large. Large differences can be expected in households in which decision-making is influenced by bargaining, provided that fathers and mothers have different preferences for the welfare of their children.

We continue in the next section by describing the data set and the construction of the dependent variable. After that, we report the estimation of potential wages. The following section reports the results of the relative NAR regressions, and the paper ends with a discussion of the findings.

The population and the data

The data used in this research was collected through a household survey, which was conducted during January-March of 1995 in the Ejana-Wolene, one of the sub-districts of the Guragie administrative zone, in the Southern region of Ethiopia. Ejana Wolene is a rural area located 240 km South of Addis Ababa, the capital of Ethiopia (figure 1). According to 1995 district administration records, total population was estimated to be 217,840. Ensete (false banana) is the major crop and food source in the region, and is grown by most households on small plots around the house. Ensete has a six-year growing cycle in which it is transplanted three or four times (Pijls et al., 1995). Men are responsible for transplanting and harvesting. Women then scrape the pseudostem in order to separate the starchy pulp from the fiber, and grind the tuber. These activities are performed in the field. The pulp is fermented and stored in earthly pits for a period lasting from a few days to five years. The fermented pulp, as well as freshly harvested tuber, is then used to prepare various food items.

Nineteen peasant associations out of the sixty-five peasant associations in the district were selected for the survey. Selection was based on accessibility and on an attempt to represent the diverse agro-economical conditions of the district. A total of 583 households were surveyed, about 31 in each of the 19 peasant associations (an average peasant association in Guragie includes around 400 households). In each peasant association the households were chosen at random with the assistance of the local chief. An enumerator was instructed to physically measure the food intakes of all household members during three consecutive days. During this period he also had to administer a questionnaire, which included questions about personal and family characteristics, food production and expenditures, income and assets, health, and time allocation.

Food intakes and nutritional status

One of the special features of our data set is that food intakes are directly measured at the individual level. The preferred method of measuring food intakes is direct weighing of servings, because of the measurement errors involved in recall and expenditure methods (Bouis, Haddad and Kennedy, 1992). This is why the Ensete-consuming population of Guragie was chosen for this study: food items made from Ensete are mostly served in individual dishes, while in the rest of Ethiopia, the common food is Enjera which is served to the whole family in a common tray. The direct weighing method has been used before in Ethiopia (Ferro-Luzzi et al., 1990) and elsewhere (Senauer, Garcia and Jacinto, 1988; Gawn et al., 1993), and proved useful. In this survey, the method was applied by first documenting the ingredients of every dish prepared, then weighing each plate of food before it was served, and finally weighing the empty plate (including left-overs) again after the meal. The enumerator also indicated which household members ate from each plate measured. In addition to the direct measurement of food intakes, household members were asked to provide information about food they ate outside the household.

Calorie content of each dish was calculated according to food composition tables available for Ethiopia. Individual daily calorie intakes were calculated by first aggregating over all food items eaten by each individual (plates were equally divided when two or more individuals shared them) and then averaging over the three observation days. As a whole, the measured daily calorie intakes seem fairly low. This is especially worrisome given that the Body Mass Index (BMI) of the sample population indicates quite normal long-run nutritional status (Kimhi, 2004). Calorie intakes are probably biased downwards due to several reasons. First, calorie intakes are positively related to the number of meals per day, which indicates a possible bias caused by unreported food, presumably eaten between regular meals. Second, in many occasions enumerators did not specify the ingredients of certain dishes in a way that is detailed enough to allow for the evaluation of calorie contents. More than one third of the people in the sample had eaten from at least one dish that was not described adequately, during the three-day survey. Obviously, our measures of calorie intakes do not include these dishes.

Recommended Dietary Allowances (RDA) were calculated using tables in National Research Council (1989), according to gender, age, physical activity, pregnancy and lactation. Four alternative values were calculated using four different ways to weight physical activities, but the differences were rather small. Details of the calculations can be found in Kimhi and Sosner (2000). Nutrition Adequacy Ratio (NAR) was computed by dividing daily calorie intakes by RDA. NAR was then aggregated by household, and the relative individual NAR was computed by dividing individual NAR by household NAR. The relative NAR serves as the dependent variable in the subsequent empirical analysis.

Work and income

As mentioned earlier, Ethiopian males and females have separate tasks in Ensete cultivation, harvesting and processing. When asked about main activity, 73% of the males older than 16 years of age in our sample defined themselves as farm workers (versus less than 1% of the females), whereas 91% of the females in the same age group defined themselves as domestic workers (verses less than 2% of the males). Other main activities are also extremely segregated by gender. 17% of the males defined themselves as traders versus 3.5% of the females. Other male-dominated activities are party official and administrator, teacher, and manual worker. Other female-dominated activities are craft worker and food seller. Significant gender differences can also be observed in educational attainments of the survey population: only 15% of adult females have any level of formal schooling, while more than half of the males do.

We have seen that males specialize in agricultural work and females specialize in domestic work. Most of agricultural production is performed on the household plot and intended for self consumption. Despite that, we have estimates of the value of agricultural production. However, it is impossible, using our data, to value domestic work. Hence, we ignore these specialized activities and focus instead on earnings from other activities for which more direct measures of wages or self-employment income are available. We include agricultural work on other farms among these income generating activities. This increases significantly the sample of males for which we can observe income.

What we call wage here is in fact the total annual income derived from one or more of the income generating activities for each individual divided by the total number of days spent by this individual in these activities. One problem we encounter with this calculation is that part of the income is received in kind, and we have to transform quantities of goods into their value. For this purpose, we have derived average price per unit of crops using three sources of information: crop sales data, food expenditure data, and data from a market survey that was conducted separately.

This task was complicated even further by the fact that income in kind was reported in nine different crops (including "other") and ten different units, some of which are weights, some are volumes, and some undefined such as “bundles”. The results of the market survey revealed that there is no single common conversion method across crops. Therefore, we have attempted to use our data to derive crop prices for each specific unit in the hope that price comparisons across units will result in acceptable unit conversions. We have used data on both crop sales and food purchases. Price variation was notable in most cases, so we looked at both mean and median prices of each unit of each crop, and verified their reasonability by a comparison to the market survey.[2] The resulting unit prices were subsequently used to convert in-kind income to cash value and aggregate all non-agricultural income by individual.[3] This was divided by the total number of days spent on these activities in order to impute a daily wage. Several cases with unreasonable wages were excluded at this stage. The resulting wage variable had both a mean and a median close to three Birrs per day, which is quite reasonable.[4]

Another data problem is that in about 7% of the cases, income was generated by more than one individual. In this case we simply divide the income, as well as days of work, equally among the individuals involved. This can result in a lower gender earnings gap, but the magnitude of this bias could not be large. After completing these calculations, we found that the average daily wage for a male worker was more than twice higher than the average daily wage for a female worker.[5]

Estimating potential wages

We used the Heckman (1979) procedure to estimate Mincerian wage equations corrected for selectivity bias, which can be subsequently used to derive potential wages for all sample population. Consider a random sample of I observations. For individual i, specify a reduced-form labor market participation equation as

$$Y_i = X_{1i}\beta_1 + U_{1i} \tag{1}$$

and an offered wage equation as

$$\ln W_i = X_{2i}\beta_2 + U_{2i} \tag{2}$$

where X_{1i} and X_{2i} are vectors of explanatory variables satisfying adequate exclusion restrictions, β_1 and β_2 are conformable vectors of parameters, and U_{1i} and U_{2i} are random disturbances drawn from a bivariate normal distribution with zero means, variances σ_1^2 and σ_2^2 respectively, and covariance σ_{12}. Assume further that wage is observed only for individuals with $Y_i > 0$. Define a dummy indicator variable of labor market participation D_i as

$$\begin{aligned} D_i &= 1 \quad \text{if } Y_i \geq 0, \\ D_i &= 0 \quad \text{if } Y_i < 0. \end{aligned} \tag{3}$$

and use this as a dependent variable in a binary probit model to obtain a consistent estimate of β_1/σ_1. The next step is to compute a consistent estimate of the inverse mills ratio, which is defined as $\lambda_i = \phi(Z_i)/[1-\Phi(Z_i)]$, where $Z_i= -X_{1i}\beta_1/\sigma_1$, and ϕ and Φ are the probability density and cumulative distribution functions, respectively, of a standard normal random variable. This is done by substituting the probit estimate instead of β_1/σ_1. Then, the wage equation parameters β_2 can be consistently estimated according to the equation

$$\ln W_i = X_{2i}\beta_2 + \frac{\sigma_{12}}{\sigma_2}\lambda_i + V_{2i}, \tag{4}$$

with the computed λ_i as an additional explanatory variable, using only the observations for which D_i=1 (which are also the observations for which wages are observed, i.e. W_i>0).

We estimated the model separately for males and females over 14 years of age. The resulting samples included 1156 males and 1133 females. 20% of the males reported labor income, while 31% of the females did so. While the log-wage equations included only age, education and location variables, the labor market participation equations included additional explanatory variables such as an indicator of household headship, number of young children, assets, an indicator of a single-parent household, and nonlabor income, which are supposed to affect the reservation wage. Table 1 provides a descriptive list of all explanatory variables used in the final version of this model (both participation and log-wage equations). Note that we have broken household assets into several categories, since different measurement problems were associated with the various asset categories.[6]

Table 2 includes descriptive statistics for the two samples used in the model. One can see that older males are more likely to work while there is no such effect among females. Males who are heads of households are more likely to work. The age and headship effects probably reflect a higher tendency to work among adults than among children. The tendency to work is inversely related to education for both males and females, which is opposite to both common sense and empirical evidence, but is positively related to having attended the adult literacy program. Perhaps the adult literacy program is better directed towards income-generating activities than formal schooling. Formal schooling could also be correlated with age, with younger people being more educated but are less likely to work. The tendency to work is also negatively related to the various types of assets and to nonlabor income, which does make sense. The tendency to work is inversely related to the household head being single, and positively related to the number of young children. As mentioned above, income earned per day of work is more than twice higher for males than for females.

The participation equation results are reported in table 3. The fit in the males' and especially the females' equations is somewhat disappointing, as the model exhibits difficulties to correctly predict the workers.[7] This is not surprising given the relatively small fractions of workers in the two subsamples. The statistically significant effects on the tendency to work are mostly similar to the patterns displayed by the descriptive statistics. Specifically, work participation has the familiar hump-shape age profile, with stronger and statistically significant age effects among females. The age coefficients imply a maximum participation age of 33 years for females. Male household heads are more likely to participate than other males. Education has a significant negative effect on participation for both males and females, and the adult literacy program has a positive effect which is significant only in the females' equation. Assets do not have significant effects on participation, with the exceptions of plot size and food storage in the males' equation and livestock in the females' equation, all having negative effects. Nonlabor income has a negative effect on labor participation which is significant only for males.

The results of the log-wage equations are reported in table 4. As opposed to the participation model, only explanatory variables reflecting the demand for labor (age, education, and location) are included here. Age was represented by cohort dummies, and the insignificant ones were excluded. Similarly, insignificant education indicators were excluded. The results show that wages are lower for young workers (under 24 years of age) and also for older female workers (over 63 years of age). Wages also rise with education: males who have more than primary education and females who attended the adult literacy program earn significantly more per day of work than others.[8] Location-specific variation in wages was also found significant in both samples.[9] Sample selectivity was important only in the females' sample.

Relative NAR regressions

Potential wages were calculated for all sample population using the coefficients of the log-wage equations discussed above. These potential wages were used as explanatory variables in the regressions explaining the relative NAR of different household members. We run these regressions for separate samples of male household heads, female household heads or spouses, and children in three different age groups: 3-13, 14-17, and 18 and up. Household members who do not belong to the nuclear family are excluded. Table 5 gives the definitions of explanatory variables included in the NAR regressions. In addition to the potential wages, individual variables include age, reading and writing ability, and an illness dummy. The illness dummy is included in order to see whether ill persons are supported or exploited by other household members in terms of food allocation.[10] For female heads/spouses we also include pregnancy and breastfeeding dummies, to see whether these women, who require higher nutritional intakes, actually get what they need. For children we also include a dummy for males and a birth order variable. The child male dummy is supposed to capture gender preferences of adult household members. Behrman (1988b) and Senauer, Garcia, and Jacinto (1988) found that rural families tend to favor boys over girls in India and the Philippines, respectively, while Haughton and Haughton (1997) found the opposite results in Vietnam. Strauss (1988) and Svedberg (1991) report no significant sex bias in their results from Africa. Birth order has been shown by Behrman (1988a), Horton (1988), Senauer, Garcia, and Jacinto (1988), and Haughton and Haughton (1997) to affect nutritional status of children, so that children born earlier enjoy more adequate nutritional intakes.

Household composition variables include the number of adults and the number of children in two different age groups. They are supposed to capture patterns of food allocation between adults and children in general, and between children of different ages. We also include, in the relevant samples, dummies for the presence of a male household head and the presence of a female household head or spouse, and dummies for pregnancy and breastfeeding of the female head/spouse. We initially included educational dummies of the household head and spouse, since education supposedly increases one's bargaining abilities, leading to a positive effect of own education on a person's share in household resources. On the other hand, education is also important for understanding the importance of adequate nutrition, so the effect could be reversed.[11] However, these variables were not found significant in any of the samples and hence were excluded from the final version.

Two other household-level explanatory variables were included in the NAR regressions. One is the aggregate household NAR, and the other is the total value of household assets. The idea behind the inclusion of these variables is that the pattern of food allocation within the household is likely to depend on the total amount of food available to the household. The allocation pattern probably loses importance as food becomes easily available, since in this situation every household member consumes food as much as wanted. This is also implied by a fairness argument (Farmer and Tiefenthaler 1995), if one is willing to accept the presumption that fairness is a luxury. On the other hand, when food is very scarce, the economic effects on food allocations may also be redundant since the food will be allocated so as to ensure subsistence and survival of all family members.[12] Therefore we expect the importance of the economic considerations to be highest among households at the intermediate level of food availability. Of these two variables, one is a direct measure of food availability (household NAR), and the other is an indirect measure (assets) representing household wealth. We also include the squared values of these variables to capture the possible nonlinear effect described above.

Three additional variables are expected to control for possible biases in the dependent variable. The first is a dummy variable indicating an error in the reporting of net dish weights, which occurred more than 10% of reported food intake. This means that the difference between gross food weight and the leftovers is not equal to the net weight reported. The error could be positive or negative, or even zero (if the net weight is the correct number). The second is the dummy for the existence of unidentified food items (unknown recipe) in the individual's food intake data, which indicates under-reporting of food intakes. Finally, we include the ratio between the number of meals eaten by a person and the average number of meals eaten by household members. Again, this variable represents possible under-reporting of food intakes.

The results are presented in table 6.[13] Looking at the wage variables first, we note that for both adult males and females, the male's wage has a significantly positive effect on relative NAR while the female's wage has a negative but insignificant effect. Therefore, allocation of calories between adult males and females within the household does not seem to be dictated by bargaining in the relevant population. No wage variable is significant in the adult children's equation. Both male and female wages have positive and significant effects on 14-17 years old children, with the female's wage having a much larger coefficient. In the young children's equation, the male's wage has a negative but insignificant coefficient, while the female's wage has a positive and significant coefficient. The conclusion is that the economic position of women has a positive influence on the relative nutritional status of children.

Age has a positive effect on relative NAR for all adults and adult children, but the effect is significant only for male heads. However, it has a significantly negative effect on relative NAR among younger children. A quadratic effect was found significant only among the youngest children, but it implies a minimum NAR at the age of 12 which is on the edge of the age range of this group. The literacy dummy has a positive effect in all samples except for the youngest children, but the effect is significant only for adult children.[14] The illness dummy does not have a significant coefficient in any of the equations.

The number of children up to six years of age in the household has a negative effect on the relative NAR in all the equations, which is statistically significant among household heads and spouses and also for the youngest children.[15] The same is true for the number of children between the ages of 14 and 17, but the coefficient of this variable is significant only in the equation of the youngest children. Overall, the number of children in the household has a negative impact on the youngest children's nutritional status. This is contrary to the results of Senauer, Garcia, and Jacinto (1988). The number of adults does not have a statistically significant coefficient in any of the equations.

A pregnant woman suffers a lower relative NAR, and her husband enjoys a higher relative NAR. The same is true for breastfeeding, although the effect on the husband is in this case not significant. In the children's equations, these variables are mostly insignificant. It looks like women who are pregnant or breastfeeding do not enjoy the full amount of additional calories they should consume according to their situation. This is similar to the results of Senauer, Garcia, and Jacinto (1988) who note, however, that this does not necessarily indicate purposeful discrimination against these women, but could simply reflect lack of adequate knowledge about the needs of pregnant and breastfeeding women, or the fear of pregnant women of having a large birth-weight baby.[16]

Having a male present increases the relative NAR of females and also children except for the intermediate age group. Perhaps this means that when the male is absent, the members of the nuclear family are exploited by other household members. The presence of a female head/spouse increases the relative NAR of adult children and decreases that of 14-17 year olds.[17] Aggregate household NAR has a negative effect on the relative NAR of the youngest children only. No significant quadratic effect was found. Household assets also have a negative effect on these children but this time it is not significant. The effect of assets on 14-17 years old children is negative and significant, with a significant positive quadratic effect, but the implied minimum level of assets is outside the sample range (larger than 17). Assets also have a significantly positive coefficient in the male head's equation. This implies that children get relatively more food in families with tighter resource constraints, and supports the subsistence/survival argument discussed above.

Female adult children enjoy a higher relative NAR, compared to male adult children, confirming the results of Haughton and Haughton (1997).[18] However, there is no significant gender difference among younger children. The child's birth order has a positive effect on his/her nutrition, but the effect is significant only for the youngest children. This is contrary to other findings in the literature.[19]

The variable which has the single most significant coefficient in all the equations is the meal ratio. The positive coefficient implies that household members who participate in more meals enjoy a larger share of available calories. This is an indication that we may be missing food items eaten by household members outside of regular meals. On the other hand, the insignificant coefficients of the unknown food dummy indicate that underestimating calorie intakes due to unidentified food items does not cause a systematic bias in the results. Errors in dish weights also seem to be largely unimportant, except for adult children.

Discussion

We have attempted to explain intrahousehold variation in calorie intakes among Ethiopian Ensete-growing households. We failed to find that the potential wages of the household head and spouse reflect their bargaining power towards each other, but we did find that the economic position of women has a positive effect on the relative nutritional status of their children.

Part of this failure may be due to the fact that potential wages were imputed using results of wage equations based on a small fraction of the population. We have seen that the predictive power of the work participation model was hampered by this fact. Also, wages were reported for many different kinds of activities which were then pooled for the estimation. Also potentially important is the systematic measurement error in the nutritional intakes, which was reflected in the NAR regression results.

Other findings imply less-than-adequate nutritional intakes of pregnant and breastfeeding women, an important role of a male household head who is physically present, and that in poorer families, children tend to be in a better nutritional status relative to their parents. We also found that adult female children are in a better nutritional status than their male counterparts, and that birth order has a positive effect on nutritional status among the youngest children.

An alternative measure of nutritional status is the traditional Body Mass Index (BMI) mentioned earlier. The advantage of using BMI is that it can be measured much more accurately, relative to actual food intakes (Strauss and Thomas 1998). We have replicated the relative NAR regressions with conformable relative BMI regressions. The results will not be reported here since most of the explanatory variables, and especially the potential wages, did not come out significant in those regressions. The exceptions were the wage of adult children which came up positive and significant, and the male head's wage which was significantly negative in the 14-17 years old children's equation. We included average household BMI among the explanatory variables, and it had a positive effect on male heads' relative BMI and a negative effect on women's and young children's relative BMI. Males tend to have lower relative BMI among adult and intermediate-age children, but not among the youngest children. Birth order had a significantly negative effect on relative BMI among 14-17 years old children only.

A future improvement in this empirical analysis could be to exploit the fact that the sum of relative NARs of all household members is equal to one.[20] An alternative would be to pick one reference person in each household, perhaps the head, and measure the NAR of other household members relative to that person. In addition, we could allow for dependence between the relative NARs of different household members, either by allowing for correlation between the error terms of the different equations, or by controlling for household-specific effects.

Our results lead to several policy implications. First, the significantly negative effect of the number of children on their relative NAR indicates that a policy aimed at reducing fertility rates may improve the nutritional status of children. On the other hand, note that we only considered the number of surviving children, so a policy aimed at reducing child mortality may lead to the opposite effect unless accompanied by additional policy measures to neutralize its effect. The negative effects of female pregnancy and breastfeeding on their relative NAR are both statistically significant and worrisome. Policy measures providing direct nutritional supplements to these women and/or the necessary information on the importance of these women's nutritional needs are called for.

Notes

[1] RDA is of course not a perfect measure of energy consumption. See Harris-White (1997).

[2] Capeau and Dercon (1998) suggested a more flexible, regression-based method to determine the prices and conversion factors.

[3] We have also looked at prices by peasant association in the hope that what we see is mainly between-region price variation, but this did not seem to be the case. Verification of reasonability was conducted as the following. If both sale price and purchase price were consistent with the market survey, their weighted average was used. If only one of them was consistent, we used that one. When market data was unavailable, and both sale price and purchase price were similar, we used their weighted average. If they were not similar, and one of them was based on a much larger number of observations, we used that one. When prices were inconsistent with market data, we used comparisons with other crop units to decide which price makes more sense. In all cases, we derived two price lists, one based on means and the other based on medians. There was no remarkable difference between income based on means and that based on medians, so we eventually used means only. For a number of cases we could not get any reasonable price data, so for these cases income is underestimated. We do not view this as a serious problem as the number of cases is in the order of 3% of total non-agricultural income observations.

[4] This was equivalent to one half of a $U.S. at the time of the survey, using the official exchange rate. Krishnan, Selassie, and Dercon (1998) found that wages in Urban Ethiopia were higher.

[5] It should be noted that Appleton, Hoddinott and Krishnan (1999) found a much smaller gender wage gap in urban Ethiopia.

[6] We did not have any measure of the values of land and trees. Deriving an aggregate value for food storage would involve price imputations as in the case of in-kind income, so we decided to only include a dummy for having food storage. Huts, livestock, and other assets were valued by the respondents, and were not aggregated in order to allow different effects of the different asset categories on different household members.

[7] A correct prediction is a case in which work is reported and the calculated probability of work is more than 0.5, or a case in which work is not reported and the calculated probability of work is less than 0.5.

[8] Verwimp (1998), in a somewhat similar study, also concluded that “entry in well-paid jobs is constrained for non-educated people” in rural Ethiopia.

[9] The location dummies were statistically significant as a group in both equations.

[10] Haughton and Haughton (1997) found that children who were ill were likely to be malnourished, but noted that illness might as well be jointly determined with the nutritional status.

[11] Strauss (1988), Thomas, Strauss, and Henriques (1990), and Haughton and Haughton (1997) found that parents’ education has a positive effect on children’s nutritional status.

[12] This last argument may be reversed in even worse conditions of starvation when certain households may allocate food unequally in order to guarantee the survival of some family members. We do not expect to have such cases in our sample.

[13] We only present the results of the variation in which RDA was based on main activity. The other variations did not produce significantly different results. The regressions included a set of locality dummy variables which are not presented in the table.

[14] The literacy dummy may be endogenous, especially for children, for two reasons. First, nutritional status and school attendance may be jointly determined by parents. Second, school achievement may be affected by the nutritional status (Schultz 1997).

[15] Perhaps this means that household members who are not members of the nuclear family benefit from the existence of young children.

[16] It could also be that the number of calories added to the RDA of pregnant and

breastfeeding women is too large for Ethiopia.

[17] Case' Lin, and McLanahan (2000) found that the presence of a mother has a positive effect on the consumption of the youngest children.

[18] Behrman (1988b) notes that boy preference has a seasonal pattern. This is not an issue in our data, though, since Enset-based nutrition is relatively independent of short-run seasonal variations.

[19] Nevertheless, Horton (1988) finds that it is the long-run nutritional status that is mostly affected by birth order, and not so much the short-run nutritional intakes that we study here.

[20] In fact we have done so implicitly by excluding household members other than the nuclear family of the household head from the analysis. Our model can be interpreted as if we had an additional NAR equation of other household members whose coefficients are normalized to zero. This interpretation is true, though, only for households for which we included exactly one male head, one spouse, and one child of each age group, which is far from reality.

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Table 1: Explanatory Variables Used in the Probit Model and/or Wage Regression[a]

Variable name	Description
Age	Age in years
Age squared	Age squared
Age_xx-yy	A dummy for individuals between xx and yy years of age
HH head	A dummy for household heads
Literacy prog	Attended the ‘adult literacy program’
Prim educ	A dummy for primary or traditional education
High educ	A dummy for more than primary education
Single head	A dummy for single-parent households
Children 0-6	Number of children under seven years of age
Plot size	Area of land plots cultivated by the household
Trees	Number of trees (both young and fruit-bearing)
Livestock	Value of livestock (4 months prior to the survey)[b]
Assets	Value of assets other than land, huts, food storage, and livestock[b]
Huts	Value of huts[b]
Food storage	A dummy for the existence of food storage in the household
Has addinc	Household has nonlabor income but amount unknown[c]
Addinc	Amount of nonlabor income[b]
Income	Market labor income[b]
Days	Days of nonfarm work (last year)
Wage	Nonfarm income per day

[a] Only variables that were included in the final version of the models are described. In previous versions we also used a breakdown of plots by quality categories and a breakdown of trees by type. These were not found significant in any of the models. The models also included village-location dummies which are not described here.

[b] In Birr.

[c] Because it was received in kind with no value attached.

Table 2: Descriptive Statistics of Participation and Wage Equations Variables

	Males		Females	
Variable name	Working	Not working	Working	Not working
Age	39.94	32.57	31.31	32.02
HH Head	0.83	0.35	0.05	0.04
Literacy prog	0.35	0.26	0.32	0.20
Prim educ	0.29	0.39	0.10	0.13
High educ	0.12	0.25	0.03	0.08
Single head	0.08	0.11	0.12	0.13
Children 0-6	1.12	0.65	0.87	0.74
Plot size	371.29	499.78	443.69	508.35
Trees	1058.38	1158.49	948.10	1177.04
Livestock	1087.55	1668.92	1303.06	1634.81
Assets	1971.33	2793.28	2895.31	3023.31
Huts	7330.60	8462.86	8338.63	8527.78
Food storage	0.82	0.90	0.87	0.89
Has addinc	0.23	0.22	0.26	0.21
Addinc	51.67	180.38	107.25	159.71
Income	383.11	0	172.33	0
Days	82.50	0	91.00	0
Wage	4.64	0	1.89	0
Count	233	923	364	769

Table 3: Probit Work Participation Results

Variable name	Males		Females	
Intercept	-0.9384	(-1.49)	-1.1699	(-2.29)*
Age	0.0008	(0.04)	0.0602	(4.19)**
Age squared	-0.0327	(-1.50)	-0.0904	(-4.73)**
HH Head	1.7471	(7.48)**	0.3597	(1.45)
Literacy prog	0.1121	(1.04)	0.3823	(3.98)**
Prim educ	-0.2669	(-2.24)*	-0.2614	(-1.90)*
High educ	-0.3022	(-1.87)*	-0.4883	(-2.51)**
Single head	0.5302	(3.02)**	-0.0031	(-0.02)
Children 0-6	0.0162	(0.26)	0.0110	(0.24)
Plot size	-0.1007	(-1.77)*	-0.0598	(-1.21)
Trees	0.0348	(0.67)	-0.0197	(-0.44)
Livestock	-0.0126	(-0.47)	-0.0484	(-2.05)*
Assets	0.0160	(0.40)	0.0300	(0.88)
Huts	0.0055	(0.10)	0.0137	(0.29)
Food storage	-0.3175	(-2.15)*	0.0667	(0.51)
Has addinc	0.0551	(0.44)	0.0477	(0.45)
Addinc	-0.0783	(-3.49)**	-0.0200	(-1.12)
PA 2	0.7086	(3.78)**	0.5780	(3.49)**
PA 3-5	0.4235	(2.46)**	0.0465	(0.30)
PA 6-9	0.3588	(1.99)*	0.4746	(3.10)**
PA 10-11	0.1147	(0.48)	0.5723	(2.84)**
PA 12-15	0.2221	(0.98)	-0.0038	(-0.02)
PA 16	0.2538	(0.86)	0.1042	(0.44)
Log-likelihood	-423.82		-635.31	
Number of cases	1142		1127	
R^2_{ef}	0.2584		0.1068	
R^2_{mz}	0.3974		0.1858	
% correct predictions				
- among workers	38.2		20.8	
- among non-workers	95.1		92.5	

Notes:
- asymptotic t-statistics in parentheses.
* - coefficient significant at the 5% level.
** - coefficient significant at the 1% level.

Table 4: Log-Wage Results

Variable name	Males		Females	
Intercept	1.1055	(4.76)**	-0.4117	(-1.133)
Age 14-23	-0.6299	(-2.74)**	-0.3112	(-3.10)**
Age 64+			-1.7224	(-3.44)**
Literacy prog			0.2638	(2.25)*
High educ	0.7061	(4.13)**		
PA 2	0.7703	(0.36)	-0.2474	(-1.27)
PA 3-5	-0.1420	(-0.71)	-0.3589	(-2.12)*
PA 6-9	0.0339	(0.17)	0.3640	(2.16)*
PA 10-11	-0.1851	(-0.81)	0.5290	(2.71)**
PA 12-15	0.1604	(0.78)	0.1460	(0.88)
PA 16	0.3372	(1.13)	0.0222	(0.09)
λ_i	0.1708	(1.09)	0.9587	(3.45)**
Standard error	0.805		0.761	
R^2	0.122		0.183	
F-statistic	3.283		6.895	

Notes:

- asymptotic t-statistics in parentheses.

* - coefficient significant at the 5% level.

** - coefficient significant at the 1% level.

Table 5: Explanatory Variables in NAR Regressions

Variable name	Description
Age	age of individual rounded to nearest year
Read & write	individual can read and write (dummy)
Illness	a dummy for being ill in the month prior to the survey
Children 0-6	number of household members up to 6 years of age
Children 7-17	number of household members from 7 to 17 years of age
Adults 18+	number of household members over 17 years of age
Mother breastfeeding	a dummy for the female head/spouse being breastfeeding
Mother pregnant	a dummy for the female head/spouse being pregnant
Male present	male household head present and participates in meals
Female present	female head/spouse present and participates in meals
Wage male	potential wage of male household head
Wage female	potential wage of female household head/spouse
Wage child	potential wage of child
Household NAR	household-level nutrition adequacy ratio
Assets	value of household assets including huts (1000 Birr)
Male	a dummy for males
Birth order	equal to 1 for eldest child, 2 for second, etc.
Error in dish weights	a dummy for a data error in consumption over 10%
Unknown recipe	a dummy for eating from a dish whose calorie contents is unknown
Relative # of meals	the ratio of the number of meals in which the person took part and the number of meals in which household members took part

Table 6: Relative NAR Results

	Male head		Female head/spouse		Child 18+		Child 14-17		Child 3-13	
	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
Intercept	-0.0198	-0.1722	0.1346	1.3723	0.2484	1.8177	0.4165	1.7245	0.8880	7.1016**
Age	0.0038	3.6198**	0.0019	1.7465	0.0036	1.5721	-0.0281	-2.2275*	-0.0993	-5.8522**
Age squared									0.0041	3.9799**
Read & write	0.0075	0.3283	0.0253	0.6048	0.0780	2.9362**	0.0064	0.2214	-0.0481	-1.7408
Illness	0.0306	1.2312	-0.0108	-0.5428	0.0222	0.4932	-0.0441	-0.7190	-0.0142	-0.3750
Children 0-6	-0.0367	-2.3270*	-0.0474	-3.5970**	-0.0040	-0.1526	-0.0209	-0.9944	-0.0396	-2.6431**
Children 7-17	-0.0040	-0.6227	-0.0077	-1.4007	-0.0063	-0.7694	-0.0112	-1.1724	-0.0234	-2.8922**
Adults 18+	-0.0006	-0.0762	0.0071	1.1603	-0.0064	-0.6928	0.0136	1.3507	-0.0088	-1.0261
Mother breastfeeding	0.0744	2.4476*	-0.1092	-4.2208**	0.0212	0.3911	0.0688	1.6303	0.0445	1.5746
Mother pregnant	0.0326	0.7748	-0.0780	-2.1863*	0.0816	1.1381	-0.0409	-0.5927	-0.0906	-2.2391*
Male present			0.1091	4.5857**	0.0669	2.0697*	-0.0135	-0.3537	0.0686	2.4745*
Female present	-0.0386	-0.7931			0.0854	2.0154*	-0.1961	-3.5506**	0.0662	1.5223
Wage male	0.0392	3.0603**	0.0215	3.4255**	-0.0182	-1.3901	0.0680	4.3000**	-0.0127	-1.4257
Wage female	-0.0685	-1.4465	-0.0352	-0.8547	-0.0536	-0.9511	0.1944	2.6478**	0.1637	3.4133**
Wage child					-0.0210	-1.5535	-0.0124	-0.3999		
Household NAR	0.0066	0.1894	-0.0428	-1.6754	-0.0151	-0.3729	-0.0417	-1.1166	-0.0688	-2.2387*
Assets	0.0044	3.8146**	0.0015	1.5221	0.0010	0.8371	-0.0153	-3.3628**	-0.0017	-1.3856
Assets squared							0.0003	2.4833*		
Male					-0.0733	-2.0289*	0.0175	0.3577	0.0162	0.8695
Birth order					0.0211	1.6341	0.0221	1.7155	0.0169	2.0366*
Error in dish weights	0.1100	1.8217	0.0013	0.0235	-0.1547	-2.1473*	-0.0021	-0.0248	-0.0840	-1.0629
Unknown recipe	-0.0215	-0.9517	-0.0195	-1.0200	-0.0248	-0.9225	-0.0171	-0.5158	-0.0152	-0.6654
Relative # of meals	0.6071	9.9075**	0.6775	10.5579**	0.6057	6.3148**	0.9234	8.7378**	0.7370	9.9451**
R^2	0.322		0.408		0.312		0.433		0.245	
F-statistic	8.822		15.821		3.879		5.987		13.054	
Number of cases	430		528		248		239		1074	

Note: t-statistics in parentheses.

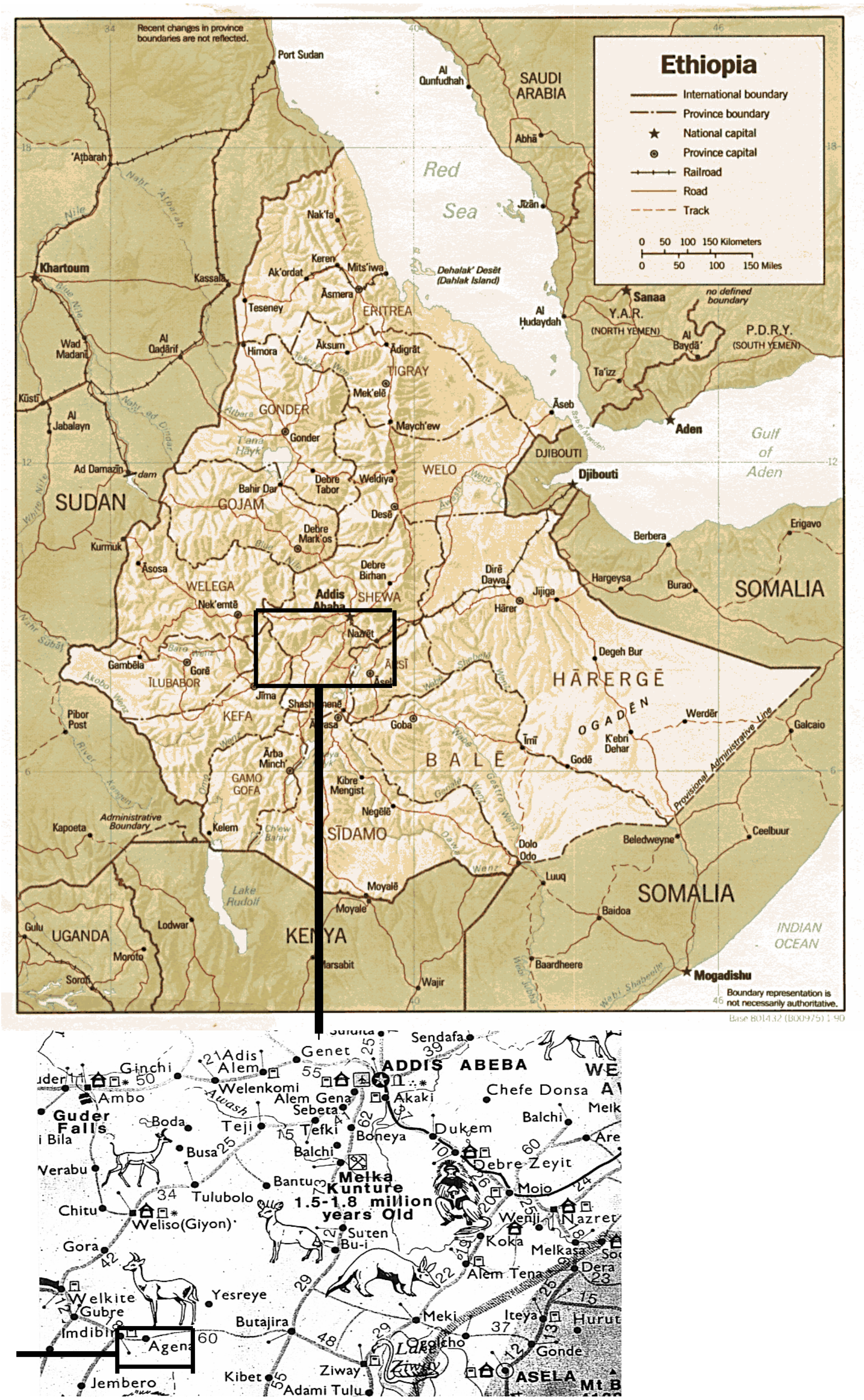

Figure 1. Map of Ethiopia and Survey Area

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