Trade-offs Among Siblings:
Children's Work and Schooling in Outcomes in Indonesia
(Extended Abstract)

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Children play an important economic role in developing countries because they work, both for pay and as unpaid labor on family farms, family businesses, or in the household by performing housework and childcare for younger siblings. While children who work may provide immediate financial contributions to the household, the short-term financial gains may come at a cost if work interferes with schooling. Whether and how much a child works may be determined in part by his or her position in the family with respect to sex and birth order. Age and gender composition of siblings has been shown to affect the human capital of children in a number of low income countries. Evidence points to the importance of the age-sex composition of siblings in determining investments in education and health. Das Gupta (1987) found that higher birth order girls in rural Punjab receive the lowest allocation of food and medical spending among all siblings. Morduch and Garg (1998) demonstrate that in Ghana children of both sexes benefit from higher health status and educational attainment when they have more sisters than brothers.

This paper uses household survey data from the Worker Iron Supplement Evaluation (WISE) to examine the effect of household demographic characteristics and sibling age-sex composition on the allocation of children's time across three major activities—schooling, market labor (both paid work performed outside the home and unpaid labor supplied to home production), and non-market labor such as housework and childcare activities. The paper offers two main advances over previous work. First, WISE provides far more detailed data on children's time use—the outcomes of parents' and children's decisions regarding the appropriate balance between work and school—than is typically available. The data will allow time use to be explicitly classified into schooling, market labor, and non-market labor activities. Second, a multilevel approach is used to account for possible household level clustering.

The data are drawn from the Worker Iron Status Evaluation (WISE) —an on-going longitudinal survey of 4,400 households in one district in Central Java, Indonesia. WISE is a NIA funded research study conducted by Professor Elizabeth Frankenberg (UCLA-Sociology), Professor Duncan Thomas (UCLA-Economics), and the Community Health and Nutrition-Research Laboratory (CHN-RL) at the Faculty of the Medicine of the University of Gadhjah Mada, Indonesia. Households are interviewed every four months for a period of 28 months. In each round of data collection all respondents over the age of eight years (nearly 17,000 individuals) are asked to complete a 24 hour recall of how they spent their time on the previous day.

These data provide detailed information on the actual allocation of time, which can be classified into the three mutually exclusive activities: market labor, non-market labor, and

schooling. The richness of the data is an improvement on past data sets used to study child time allocation because the lack of detailed data on children's time allocation in the past has restricted the literature to considering only market oriented labor, such as paid labor performed outside the home and unpaid labor used in home production, as the sole form of child labor. Therefore, in the past literature, housework/childcare activities were excluded from the general analysis. In developing countries, neglecting to examine housework activities severely underestimates the burden placed on children, particularly female children, because poor domestic infrastructure, such as limited access to electricity and running water, contributes to housework/childcare demands.

The paper employs a multilevel framework to account for possible household level clustering. The inherent problem that arises with the use of stratified samples is that individual observations are not independent of each other. For example, children within a household are more likely to share unobserved characteristics than children across households. As a result, the average correlation between variables measured on children from the same household (or intra-class correlation) will be higher than the average correlation between variables measured on children from different households (or inter-class correlation). To correct for this, I will estimate children's labor and schooling participation within a multilevel framework using random effect Tobit and Poisson regressions which explicitly models the possibility of inter-class correlation.

Two random effect Tobits are used to estimate child participation in market and non-market employment, separately. A third model is employed to estimate schooling outcome using a random effects Poisson regression model.

For the purposes of the paper, children are defined to be between the ages of 8 to 18 years old. Market labor includes time spent on the following activities within a 24 hour period: work around the farm or homestead, manual labor work, construction/building activities, retail/sales, and work as domestic servant/gardener. Non-market labor includes activities such as cooking/shopping for family, cleaning/dusting/ironing/other household chores, fetching water/firewood, and all activities associated with tending to the sick, elderly and children. Schooling progress is measured in terms of schooling-for-age, or SAGE (Pscharopoulos and Yang 1991; Patrinos and Pscharopoulos 1997), which is employed to better capture schooling distortions over-time. SAGE is calculated as a ratio of the child's actual schooling level versus the child's ideal schooling level had he/she entered school at the required age (i.e. 7 years old).

Individual Level Independent Variables. In previous studies of the determinants of child time allocation, the number of total siblings living in the household, number of brothers, and number of sisters are common variables employed in the analysis to capture aspects of the sibling composition (Patrinos and Psacharopolous, 1997; Ilahi, 2002). In this study, I am interested in examining the age-sex composition of siblings as a determinant of child's time allocation. To measure simultaneously the effect of birth order and gender dimensions in sibling composition, I create individual level variables to capture the total number of older sisters and brothers, and the total number of younger sisters and

brothers for each individual respondent. Other individual level variables include age and age-squared of respondent, and gender.

Household Level Independent Variables. Household wealth is used as the main measure of socio-economic status and is defined as total household assets, which include the value of the house, land, vehicles, savings and stocks. Wealth is used instead of other measures such as household income or consumption in order to avoid the problem of endogeneity. While it is likely that child labor has a significant impact on the day-to-day expenditures of households, it is much less likely that the financial contributions of children influence such things as household saving and/or the value of household property. This assumption rests on evidence that child labor is not used by parents to accumulate wealth, but rather to insure against fluctuations in household consumption.

Mothers' and fathers' highest level of educational attainment is accounted for separately in order to explicitly model the possibility that parental education may have different effects depending on the gender of the parent. Parental age is included to capture the possible life-cycle effects that parental age may have on fertility and household size. A dummy variable for rural residence is also included.

Preliminary results for time spent working on market and non-market activities are presented. The results suggest that sex and birth order affect time spent working. Boys are more likely to engage in market labor and girls are more likely to engage in non-market labor. Older siblings spend more time on labor activities than younger siblings. Additionally, individual level characteristics, which include sex, gender, and sibling composition variables, play a greater role in explaining both market and non-market labor participation than household level characteristics.

Tables 1 and 2 illustrate the impact of sibling composition on time spent working from the perspective of boys and girls. The tables provide the additional expected hours of labor participation for any given individual relative to the individual with the lowest expected labor participation. With respect to market labor, boys with 1 younger sister and 1 younger brother spend the most time working at this activity, while girls with no brothers and 1 older sister spend the least time. Specifically, boys with 1 younger sister and 1 younger brother work near 3.5 hours more than girls with no brothers and 1 older sister. Likewise, females with 1 younger sister and 1 younger brother engage in the most hours of non-market labor while boys with no brothers and 1 older sister engage in the least. Girls with 1 younger sister and 1 younger brother work 2.2 hours more than boys with no brothers and 1 older sister.

Several additional questions will be addressed in the full paper. First, the model of schooling progress will be estimated in order to determine the impact of sibling composition and household level characteristics on educational outcome. Second, I am interested in extending the analysis to explore the impact of child labor on schooling progress. For example, how does the distribution of time across labor activities affect educational outcomes among siblings?

Table 1: Expected Marginal Hours Spent on Market Labor Activities for Boys and Girls with Various Sibling Compositions

Male	*No sisters*	*1 younger sister*	*1 older sister*
No brothers	1.58	2.06	1.62
1 younger brother	2.37	3.42	2.41
1 older brother	2.22	2.70	2.85
Female	*No sisters*	*1 younger sister*	*1 older sister*
No brothers	0.38	1.09	0
1 younger brother	1.00	1.72	0.63
1 older brother	1.01	1.50	0.41

Note: Based off of Tobit regression of market labor participation controlling only for individual level characteristics (N=1751).

Table 2: Expected Hours Spent on Non-Market Labor Activities for Boys and Girls with Various Sibling Compositions

Male	*No sisters*	*1 younger sister*	*1 older sister*
No brothers	0.04	0.37	0
1 younger brother	0.90	1.22	0.85
1 older brother	0.70	1.03	0.66
Female	*No sisters*	*1 younger sister*	*1 older sister*
No brothers	1.27	1.77	1.16
1 younger brother	1.70	2.20	1.59
1 older brother	1.61	2.11	1.50

Note: Based off of Tobit regression of non-market labor participation controlling only for individual level characteristics (N=2366).