The intra-household allocation of children's time in four developing countries

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Abstract

We study children's time use patterns in Ethiopia, India, Peru, and Vietnam, using the Young Lives Longitudinal study. We develop a framework that describes how children's time use varies within the household, and show empirically that intra-household patterns reflect the relative productivity of children's time spent on work, study, and leisure. Investigating intra-household differences in time use using household fixed effects regressions, we document a large leisure deficit for girls, highlighting a gender gap that has received little attention. We use the concept of time poverty to further investigate the nature of the leisure deficit and use a relative poverty line. The gender gap in the incidence of leisure poverty emerges at an early age, and is spread along the wealth distribution. Our findings relate to the literature on time poverty of women in developing countries, and have implications for promoting gender equality under Sustainable Development Goal target 5.4 on unpaid care and domestic work.

Keywords: Time use, leisure, schooling, intra-household allocation, domestic work, time poverty, Sustainable Development Goals, gender equality.

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Section 1: Introduction

Time is unique as an economic resource in that all individuals - regardless of age, race, or income - are endowed with the same amount of it. Analysis of how people choose to spend that common endowment has developed since the 1960s. From Becker's (1965) seminal theoretical paper on time allocation emerged an empirical development literature in the 1970s and 1980s, summarized in Strauss and Thomas (1995, 1998). This mostly focused on adult time allocation between market and non-market labor.

More recently, concurrent with the global call for recognizing, reducing and redistributing unpaid domestic work to promote gender equality under Sustainable Development Goal 5, there is renewed focus on time allocation research that tracks different types of non-market time uses, such as childcare, chores, and leisure. While data limitations have historically constrained this agenda (Hirway 2010), advances in time use data collection are deepening our understanding of how people in developing countries conduct their daily lives and how policies and programs shift people's time use (Floro and King 2016).

Gender is a particularly salient aspect of time allocation. Rubiano and Viollaz (2018) analyze gender differences in time use for 19 countries (pointing out in the process that time use data is unavailable for 135 countries) and find that men spend about five hours per day on market work and two hours per day on unpaid domestic work, while those numbers are flipped for women. Arora (2015) documents the excessive work burden of women relative to men in rural Mozambique.

Such gender differentials in time use are known to exist at younger ages, but are less well-documented. Data on children's time use in developing countries have only started to become

available in recent years. Surveys typically collect information on the socio-economic characteristics of household members, and infrequently ask about time spent on daily activities unless it is a central purpose of the project (e.g. in the American Time Use Survey). As a result, there is relatively little evidence on how children's time is allocated in developing countries.

At the same time, how children spend their time in formative years is particularly consequential, because it determines not only their current happiness and productivity, but also their future productivity. A growing literature supports common sense that time use is consequential for learning. For example, Fiorini & Keane (2014) demonstrate the importance of study time (particularly with parents) for developing cognitive skills in Australia, while Emerson et al. (2014) find that child labor has deleterious effects on learning outcomes of Brazilian students. Krutikova and Singh (2017) find a consistent and positive association of test scores and time spent on studying at home for adolescents in the older cohort in the Young Lives study. In a long-running experiment in Jamaica, Gertler et al. (2014) find that play can be a stimulating activity that promotes children's cognitive development and future earnings. Time use is also likely to have great bearing on children's general satisfaction with life. Because the activities they engage in from an early age have implications for children's present and future, it is important to understand their time use patterns.

Within a household, individuals' units of time can complements or substitutes, depending on the use, especially for children (e.g., playing together vs. taking turns with chores). In particular, a child's allocation of time depends on how co-resident siblings allocate their time (Ferreira et al. 2017). Notable studies of children's time use include those by Lloyd et al. (2008), who use data

from five developing countries to show that adolescent girls bear a heavier work burden (due to non-market labor) and spend less time on leisure than boys, and Hsin (2007), who finds the same for younger children using data from Indonesia. However, rarely do such studies have data that allow intra-household comparisons.

We analyze Young Lives' internationally comparable data for children age five to 18, using the household roster structure of the data to isolate the effect of gender, age, academic ability, and birth order. To guide our analysis, we use a conceptual framework wherein differential productivity in home production of non-tradeable consumption generates variation in the intra-household distribution of time use. We then explore the correlates of intra-household variation in time use.

Unsurprisingly, we find that older children work and study more (highlighting their relative productivity in both activities), especially when they have younger siblings. Our most consistent finding across the four countries is that girls work more and spend less time on leisure, perhaps reflecting social norms that cast girls as more suited or productive in domestic chores. We further characterize the leisure gap for girls, and find that it emerges at an early age.

The rest of the paper is organized as follows. Section 2 describes a conceptual framework of time use distribution within a household. Section 3 describes the data in more detail. In Section 4, we identify the correlates of time use based on intra-household analysis and investigate the female leisure deficit that we observe in that analysis. Section 5 concludes and discusses implications of this study for promoting economic gender equality.

Section 2: Conceptual Framework

We outline a simple conceptual framework that explains the decision-making process that determines the distribution of children's time use within a household. Although we heavily draw from the framework laid out in Edmonds (2006), there is one major difference. Like in the model of Ravallion and Wodon (2000), total time is divided among studying, working and leisure instead of just studying and working, and leisure is also part of the allocation problem.

Consider a utility-maximizing household with N children. The household has an endowment Y, which could be derived from wealth or adult labor earnings. Child i's time endowment T is allocated across three uses: education S_i, work L_i, and leisure H_i. Children's work adds to the household consumption, C as follows:

$$C = Y + \sum_{i=1}^{N} w(\theta_i) L_i$$

where $w(\theta_i)$ reflects the labor productivity of child i, which depends on a vector of child characteristics θ_i (e.g., age, gender, strength). One can think of $w(\theta_i)$ as the implicit wage for the market and non-market labor undertaken by child i.

In addition, the parents care about children's human capital, which depends on their study time and leisure time. Both these activities contribute positively to children's human capital and this relationship is characterized by $R(S_i, H_i, \eta_i; z)$, where η_i is a vector of child characteristics that affect human capital productivity (such as intelligence, age, personality, some of which may overlap with θ_i) and z is a set of household-level variables that affect productivity (such as parents' education or financial resources).

The reason for including schooling in human capital production is obvious. In the case of leisure, we are motivated by the evidence that both sleep and play (especially time spent with adults) promote both cognitive and non-cognitive child development (Dewald et al. 2010; Ginsburg et al. 2007; Whitebread et al. 2017)[1]. One can think of human capital as contributing to the household's utility either due to the intrinsic value of education and leisure or because it raises expected future earnings by producing an educated, well-rounded child. We make the simplifying assumption that the household does not exhibit inequality aversion, and cares equally about each child's human capital.

Utility is increasing and concave in consumption. Unlike Ravallion and Wodon (2000), we assume that consumption and human capital are additively separable. The household's problem is to choose $C, (L_1, \dots, L_N), (S_1, \dots, S_N)$ and $(H_1, \dots, H_N)$ to maximize:

$$U(C) + \sum_{i=1}^{N} R(S_i, H_i, \eta_i; z)$$

subject to:

$$(2.1)\ C \leq Y + \sum_{i=1}^{N} w(\theta_i) L_i$$

$$(2.2)\ S_i + L_i + H_i \leq T, \forall\, i$$

$$(2.3)\ L_i \geq 0, \forall\, i$$

$$(2.4)\ S_i \geq \underline{S}, \forall\, i$$

[1] Consumption could also be included in R_i, but we exclude it since the data does not include child-specific consumption and adding it would not substantially change the key predictions for our purposes.

$$(2.5)\ H_i \geq \underline{H}, \forall\ i$$

A minimum positive lower bound is used for study time and leisure instead of a non-negativity constraint, as the vast majority of children in all four countries attend school, and there is a biological minimum need for children's sleep time [2,3]. We further assume that $0 < \underline{S} + \underline{H} < T$.

This setup has to be qualified in several respects. In this framework, parents make the decision to allocate children's total time across different uses. While a child may have different preferences, the implicit assumption is the parental allocation accounts for them. One can imagine that through η_i, R captures children's preferences over studying and leisure in addition to the value derived by parents. We also assume that the number of siblings within the household is fixed; parents cannot respond to the equilibrium of this problem by having more children[4].

The Kuhn-Tucker (KT) conditions that characterize the household's problem are[5]:

$$\frac{\partial U(C;z)}{\partial C} + \delta_1 = 0 \qquad (KT1)$$

$$\frac{\partial U(C;z)}{\partial L_i} w(\theta_i) + \delta_1 w(\theta_i) + \delta_{2i} - \delta_{3i} = 0, \forall\ i \qquad (KT2)$$

$$\frac{\partial R(S_i, H_i, \eta_i; z)}{\partial S_i} + \delta_{2i} - \delta_{4i}, \forall\ i = 0$$

[2] Even without constraint (3) the optimal choices of S_i and H_i will be positive if Inada conditions hold.
[3] Almost all the children in our sample are enrolled in school and have positive leisure.
[4] Since 12 is the average age of children in the data we discuss in Section 3, this is not an unreasonable assumption for our analysis in Section 4.
[5] The complementary slackness conditions are presented in the Appendix.

$$(KT3)$$

$$\frac{\partial R(S_i, H_i, \eta_i; z)}{\partial H_i} + \delta_{2i} - \delta_{5i}, \forall\, i = 0$$

$$(KT4)$$

In the case of a positive solution for all time uses (i.e., (4) and (5) are not binding so that $S_i > \underline{S}$ and $H_i > \underline{H}$):

$$w(\theta_i) * \frac{\partial U(C; z)}{\partial L_i} = \frac{\partial R(S_i, H_i, \eta_i; z)}{\partial S_i} = \frac{\partial R(S_i, H_i, \eta_i; z)}{\partial H_i}$$

If we compare any two children i and j in the household, the ratio of marginal productivities of their leisure will be equal to the ratio of marginal productivities of their schooling and the ratio of marginal utilities of their implicit wages:

$$\frac{w(\theta_i) * \partial U(C; z)/\partial L_i}{w(\theta_j) * \partial U(C; z)/\partial L_j} = \frac{\partial R(S_i, H_i, \eta_i, z)/\partial H_i}{\partial R\big(S_i, H_i, \eta_j, z\big)/\partial H_j} = \frac{\partial R(S_i, H_i, \eta_i, z)/\partial S_i}{\partial R\big(S_i, H_j, \eta_i, z\big)/\partial S_j}$$

Let us examine the implications of this model via comparative statics. Since z is common to siblings, intra-household differences in time use will be driven by η_i and θ_i. If children get better at work as they age (i.e., θ_i includes age), then deviation from the average time spent on labor by children in a household will be higher for older children. If girls are perceived to be more productive than boys in the types of jobs that are most available to school-aged children (largely domestic work) due to conditioned gendered skills or cultural norms, then θ_i will include gender, and we will observe that the deviation from average time spent on labor will be positive for girls. Similarly, the deviation from average time spent on work would be higher for children with younger siblings, because the demand for their domestic labor (childcare and other chores) would be higher.

Thus by inferring how children's demographic characteristics would affect the demand for their labor, we can describe likely intra-household patterns in work time. However, without further characterization of the human capital function $R(.)$ (and in particular, whether θ_i and η_i have elements in common), the effect of children's characteristics on the other two time uses (leisure and schooling) is ambiguous. This is a question we take to the empirics in Section 4, after describing the data in Section 3.

Section 3: Data

We use the Young Lives Longitudinal Study for the analysis. It follows two cohorts of children in four countries - Ethiopia, India (Andhra Pradesh State), Peru and Vietnam. The sample in each country consists of two age groups: a Younger Cohort of 2,000 children who were aged between six and eighteen months when Round 1 of the survey was carried out in 2002, and an Older Cohort of 1,000 children then aged between 7.5 and 8.5 years. Rounds 2, 3, 4 and 5 of the survey were conducted in 2006, 2009, 2013 and 2016, respectively. We focus on the Younger Cohort in this paper. The children in this cohort were selected from twenty sampling sites. These sites were chosen in 2001 to be representative of the region. Within each sampling site, all households were screened to compile a list of eligible households (with children aged one in 2001). From that list of households, a sample of 100 households with children born between January 2001 and May 2002 was randomly selected for each sampling site.

In each round, rich data on the lives of the children in the target age windows for the two cohorts ("index children") were collected, including details on their aspirations, consumption, daily routine, health, personality, and more. In addition to the data on the index child, limited

information was collected on the index children's siblings between ages five and 18, including their typical daily time use during the preceding week. The respondent was asked about each child's typical time spent per day at school and studying at home (hereafter study time), sleeping and playing, and on domestic, farm, or market tasks (hereafter work time) to the nearest half hour[6].

We use Round 4 and Round 5 for the analysis, because the data on time use was most complete for those rounds. Households in urban areas comprise of 36% of the sample for Ethiopia, 28% of the sample for India, 73% of the sample for Peru, and 20% of the sample for Vietnam. Samples are equally split between boys and girls.

Attrition of index children was very low in India and Vietnam: less than 3% of the children in the Younger Cohort were not tracked across five rounds. In Ethiopia, however, 5% of the children in the Younger Cohort were not tracked across five rounds, and in Peru 9% were lost by Round 5.

Because siblings aged into and out of the age window for time use collection (5 to 18 years old) between rounds, there is more attrition for the full roster of children than for the index children. The household rosters in Round 4 have about 3,900 children from Ethiopia, 3,800 children from India, 4,500 from Peru, and about 3,200 children from Vietnam. The final sample in Round 5 has about 3,900 children from Ethiopia, 3,700 children from India, 4,200 children from Peru, and about 2,700 children from Vietnam. Of these, about 2,800 children were surveyed in both rounds in Ethiopia, 2,700 children were surveyed in both rounds in India, 4,000 were surveyed in both rounds

[6] The respondent was given 24 pebbles and each represented one hour. For every child in the roster, the respondent assigned these pebbles to a list of eight activities to indicate the child's time use for these activities. It was ensured that all the pebbles were allocated.

in Peru, and 2,000 were surveyed in both rounds in Vietnam[7]. Nearly all children were still enrolled in Round 4.

Table 1 describes the average time use levels across three countries. In all four countries, children average between 9 and 10 hours of sleep per day. In Ethiopia, the average child spent 4.9 hours in school (which includes travelling time), 1.2 hours on studying at home, 4.1 hours on working, 4.3hours at play, and 9.5 hours sleeping in Round 4. Of the time spent on work, 1.7 hours are spent doing domestic chores and 1.6 hours on other unpaid activities. Only 11% children were not involved in any work activity. In India, the average child spent 7.7 hours at school and 1.7 hours studying at home, 1.3 hours on working, 4.2 hours playing, and 8.9 hours sleeping. In sharp contrast to Ethiopia, 38% children in India do not spend any time on work. In Peru, the average child spent 5.8 hours at school, 1.9 hours on studying at home, 2.4 hours on work (largely domestic chores), 4.2 hours playing, and 9.7 hours sleeping. 20% of children in Peru do zero work hours on average. In Vietnam, the average child spent 5.4 hours at school, 2.4 hours on studying at home, 1.9 hours on work (largely domestic chores), 5.3 hours playing, and 9.1 hours sleeping. In Vietnam, 33% children do not work at all.

These average levels of time use mask substantial heterogeneity within (and between) a household, and by child characteristics. How time use varies by those characteristics is a key question. Therefore, it is important to understand the intra-household distribution of activities, and especially

[7] Most of those who were interviewed in Round 4 and not in Round 5 were older children who aged out of the roster, and most of those who were interviewed in Round 5 and not in Round 4 were younger children who were added to the roster.

how time use varies with gender. In the next section, we explore this question in detail, before investigating the significant female leisure deficit that we identify.

Section 4: Results

Correlates of intra-household time allocation

We interpret reported time uses as the result of an intra-household allocation decision[8] that assigns children to different tasks depending on comparative advantages relative to their siblings. If this is the case, substantial variation in children's time use will be driven by variation within the household. To separate the contributions of within-household and between-household components of overall variation in time use, we use the Generalized Entropy Index[9] with parameter value of two (hereafter $GE(2)$):

$$GE(2) = \frac{1}{2N{\mu_{ah}}^2} * \sum_{i=1}^{N} (t_{iah} - \mu_{ah})^2 \quad (4.1)$$

where t_{iah} is the time spent on an activity a by child i in household h, μ_{ah} is the average time spent by all individuals and N is the total number of individuals. The advantage of using $GE(2)$ measure of variation is that it allows us to fully decompose the total variation into its within-household and between-household components.

We implement this decomposition for four uses of time. We split leisure into play and sleep, because the variation in sleep is low (Table 2)[10]. The within-household variation in all time uses represents a substantial proportion of the total variation. In Ethiopia, within household variation

[8] We are agnostic about whether that decision is arrived at by a unitary or joint decision-making process. Although this is an important consideration with respect to policy, it has no bearing on our descriptive results.
[9] See Theil (1967) and Bourguignon (1979) for discussion.
[10] All results that follow are qualitatively similar if we combine sleep and play into a single time use (leisure).

represents about one-half of the total variation in the four uses of time. In India, within-household variation accounts for between 33% of variation in sleep time and 53% of variation for work time. For Peru nearly one-half of variation in time use is within-household, and for Vietnam it is around one-third of total variation.

Since a high proportion of the total variation in time use is within-household, it is instructive to explore its covariates. Our analysis explores the child-level determinants of time use using a household fixed effects model. The conceptual framework implies a set of optimal decision rules for each child:

$$t_{iah} = f_a(\eta_i, \theta_i, z) \quad (4.2)$$

where t_{iah} is the time that child i in household h spends on activity a in hours. We estimate a linear relationship between t_{iah} and child characteristics:

$$t_{iah} = \beta_0^a + \beta_1^a Age_{ih} + \beta_2^a Age_{ih}^2 + \beta_3^a Female_{ih} + \beta_4^a Age\ Rank_{ih} + \gamma_h^a + \varepsilon_{iah} \quad (4.3)$$

The covariates are largely the same as in the intra-household analysis of Akresh et al. (2012). Age_i and Age^2_{ih} denote child i's age and age squared, respectively. $Female_{ih}$ is an indicator for whether the child is female, and $Age\ Rank_{ih}$ captures the age rank of the child among her siblings: the oldest child is assigned a rank one, and so on. Household fixed effects are captured by γ_h. We report robust standard errors that are clustered at the level of the sampling unit. These regressions are separately estimated for the four countries, and for Round 4 and 5. For ease of interpretation of the magnitudes of coefficients on child characteristics, we use standardized t_{iah} as our dependent variable.

Table 3 shows the results for the Ethiopian sample in Round 4. There is a large age gradient for study time (0.53 standard deviations per year) and for work time (0.28 standard deviations per year). Females' play time is 0.10 standard deviations lower than their male siblings', and they sleep less by 0.07 standard deviations (p-value=0.10). Younger siblings study less (by 0.20 standard deviations) and play and sleep more (by 0.17 standard deviations each) for each elder sibling.

Results from the Round 4 survey for India (Table 4) suggest that there is a strong age gradient for work time and study time, with study time increasing by 0.41 standard deviations per year. Females spend more time working than their male siblings: their work time is 0.18 deviations higher. Higher work time for older children and girls is accompanied by lower play and sleep time. Age rank is not a significant correlate of either study and work time.

Table 5 shows that for the Peru sample, work time increases by 0.50 standard deviations with each year. Girls face a leisure deficit here too, working more, playing less, and sleeping less, by about 0.10 standard deviations on each use of time. Work time decreases by 0.13 standard deviation with each elder sibling.

Table 6 presents the results for Vietnam. As in Ethiopia, India, and Peru there is a steep age gradient in time spent on work related activities; work time increases by 0.27 standard deviations per year. There is a leisure deficit for girls just as in the other three countries, with girls playing less (by 0.21 standard deviations and sleeping less (by 0.10 standard deviations). In addition, age rank is an important determinant of intra-household time use, with work time decreasing by 0.35 standard deviations for each elder sibling.

In summary, results from Round 4 for the four countries are broadly consistent with the model. We find that older children work and study more in all four countries (though the p-value for work time is 0.15 for India), highlighting their relative productivity in these activities and the increasing availability of markets for children's work as they grow older The birth order variable is negatively correlated with work time for all countries but India, suggesting that work responsibilities are at least partly driven by the need to care for younger siblings.

The most consistent result from the intra-household regressions is that girls spend significantly less time on play (between 0.1 and 0.2 standard deviations less) and sleep. That leisure deficit is mostly due to a higher work burden on girls (Ethiopia is the exception). The strength of this gender effect is striking because it comes after controlling for not only other child-specific characteristics (age, birth order), but also after eliminating all inter-household differences (wealth, family size, parental education, etc.) via the household fixed effects specification. Within the same household, girls work more and spend significantly less time on leisure than their male counterparts, perhaps reflecting social norms that cast girls as more suited or productive in domestic chores, which dominate as the form of child labor in these samples.

Tables 7, 8, 9, and 10 show that results from Round 5 are similar to those for Round 4, with older and elder children working and studying more, and girls doing more work and less leisure. One major difference is that by Round 5 a larger positive study differential for girls emerges for Ethiopia and Vietnam. But here again, the female leisure deficit is consistent and large, and clearly not an irregularity observed in Round 4.

Investigating the gendered leisure deficit

We use the concept of time poverty (Vickery 1977) to further investigate the nature of the leisure (defined as sleep and play) deficit. Time poverty is the state of having insufficient discretionary time for leisure and rest after accounting for time needed for work and other responsibilities. Several studies have identified that adult women suffer from time poverty more than their male counterparts in developing countries (Bardasi and Wodon 2010, Wodon and Blackden 2006, Zacharias et al. 2012).

Applying this concept to children's time use, we follow Wodon and Blackden (2006) in setting a relative time poverty line. First, we use the regression model from Equation 4.3 to predict leisure time (play and sleep) for each child. Then we define three age groups (5-9, 10-14, and 15-18), and consider a child to be leisure poor if their predicted leisure hours fall below the 25^{th} percentile of the distribution of leisure time for their age group. Although this is an arbitrary line, our main conclusions are robust to this choice.

Using this definition of leisure poverty and Round 4 data, we find that girls have a heightened incidence of leisure poverty relative to boys, starting from an early age. For Ethiopia, Peru, and Vietnam (Figures 1, 3, and 4), the gap is evident even from age six. For India (Figure 2), the gap emerges at age eight.

In addition, plotting the incidence of time poverty over the wealth distribution, we find that the leisure poor girls are distributed evenly across the wealth distribution. The gender gap in the incidence of leisure poverty does not narrow, even for the richest households across the four

countries (Figures 5, 6, 7, and 8). These findings on the intersection of leisure poverty and wealth poverty are comparable to that of Brown et al. (2018) on malnutrition and wealth poverty. They use demographic and health surveys from Sub-Saharan Africa and conclude that undernourished women and children are not concentrated in poor households, similar to our finding that leisure-poor girls are not concentrated in wealth-poor households.

Section 5: Conclusion

We used Young Lives Longitudinal Study to analyze the intra-household distribution of children's time use. It is noteworthy that significant variation in children's time use is due to the within-household component. Child characteristics determine the intra-household differences of time-use in a way that is consistent with children's expected comparative advantages in domestic work and education.

One consistent result across the four analyzed samples is that girls carry a notably larger work burden than their brothers, and spend less time at play and sleep. While gender gaps in health and education have been documented in a number of settings, this analysis has demonstrated important gaps on a relatively underexplored dimension: time. The female leisure deficit emerges within families from an early age and persists as children grow older. Our finding that the gender leisure deficit persists across the wealth distribution implies that gender-sensitive development programs for youth (after school clubs, mentorship programs, etc.) should not be targeted by socioeconomic status.

Studies on gendered time poverty suggest that provision of local infrastructure investments (electricity, transportation, sanitation, water supply) may attenuate the gap by reducing the demand for housework in many developing settings (ADB 2015; Koolwal and van de Walle 2013). Cultural norms that favor sons interact with the lack of such public goods to further exacerbate gendered time poverty (Jayachandran 2015). Cultural norms are not immutable. In a recent study, Dhar et al. (2018) show that a social campaign engaging children in discussions about gender equality led to more progressive gender attitudes. Explicitly studying the effect of such interventions on time allocation is a promising avenue for future research.

Sustainable Development Goal target 5.4 is to promote "shared responsibility within the household and family" for unpaid care and work. The consistency of the leisure gap at an early age and across the wealth distribution confirms that the domestic workload imbalance that provides the impetus for that target is deeply entrenched. Any policies and programs to address it must intervene early in family life, across all socioeconomic groups.

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Appendix 1: Figures

Figure 1: Incidence of leisure poverty by age, Ethiopia

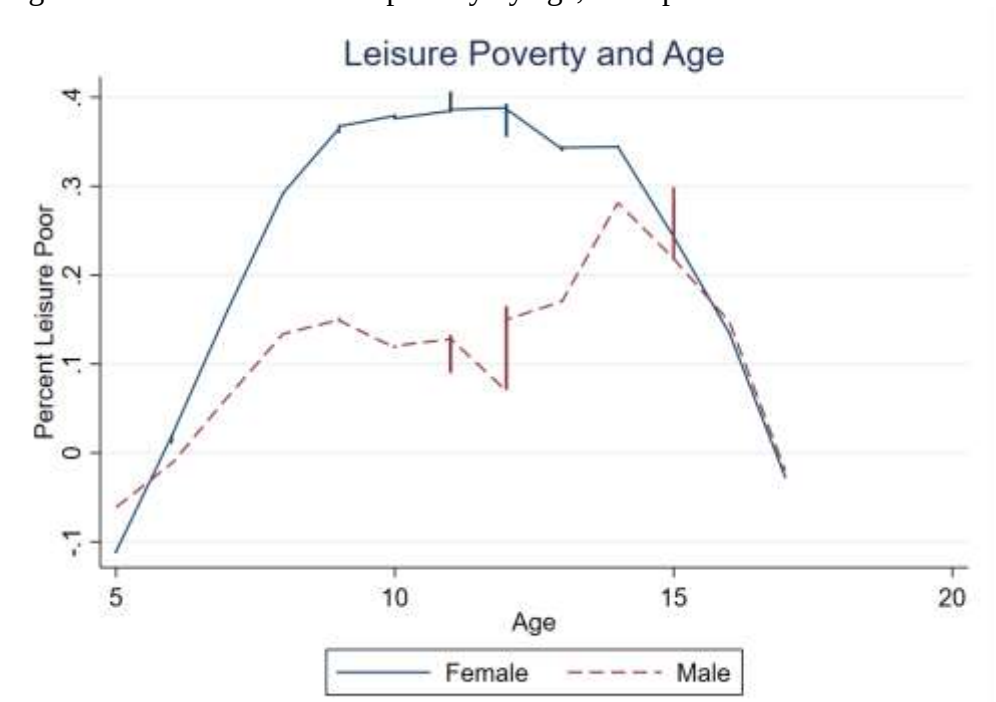


Figure 2: Incidence of leisure poverty by age, India

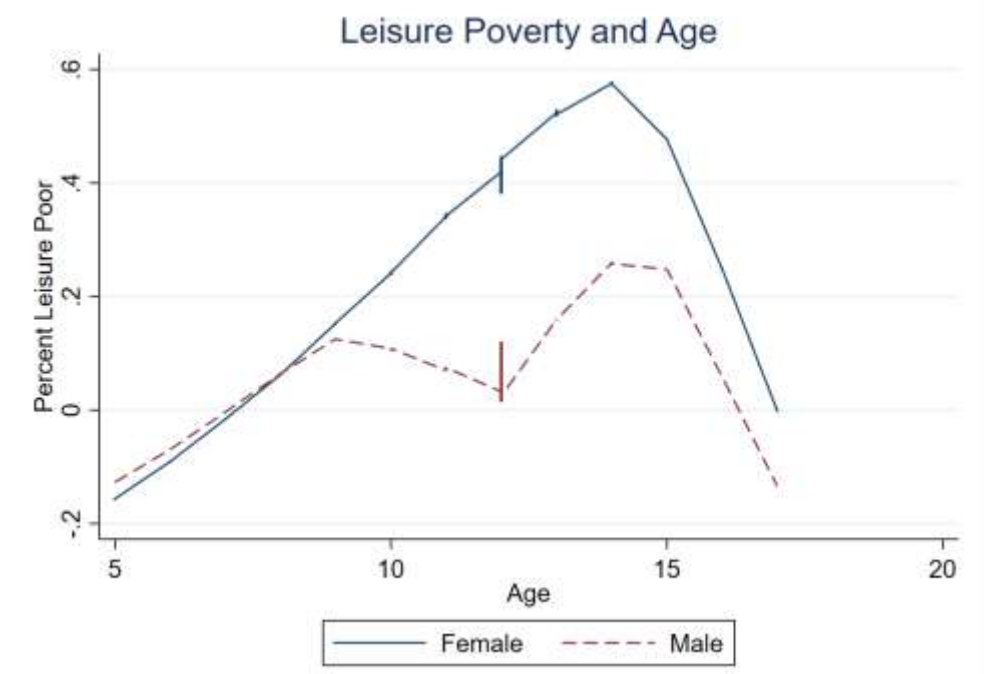


Figure 3: Incidence of leisure poverty by age, Peru

Figure 4: Incidence of leisure poverty by age, Vietnam

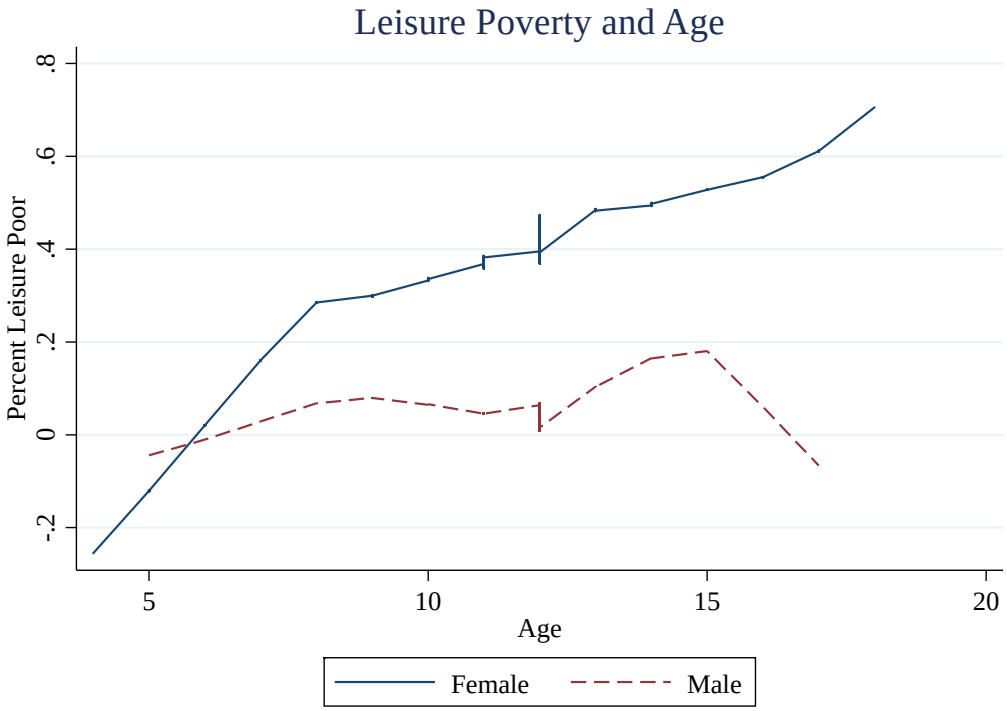


Figure 5: Incidence of leisure poverty by wealth, Ethiopia

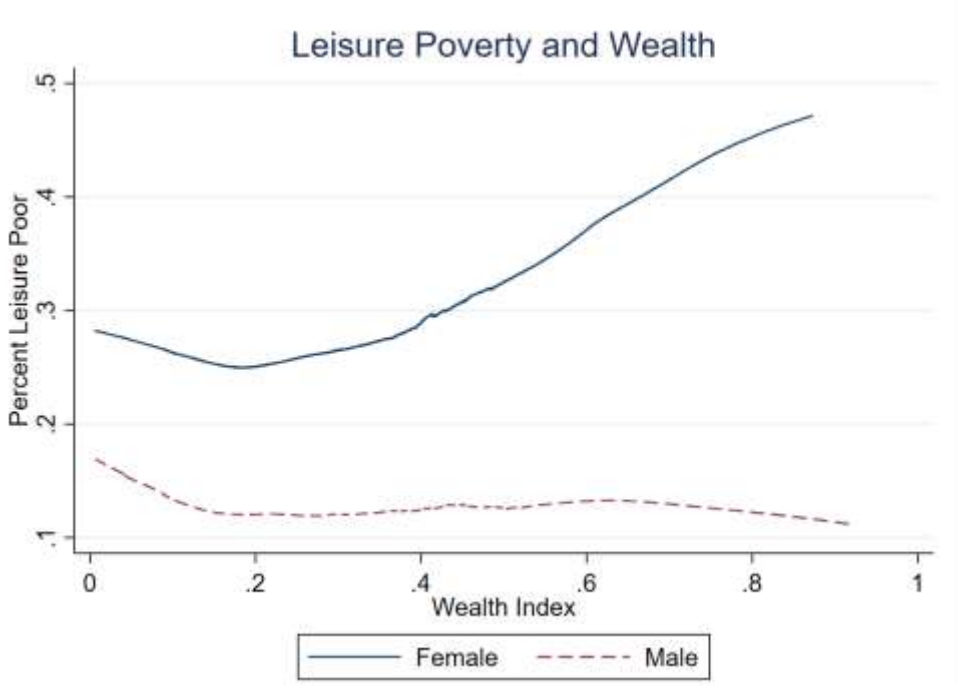


Figure 6: Incidence of leisure poverty by wealth, India

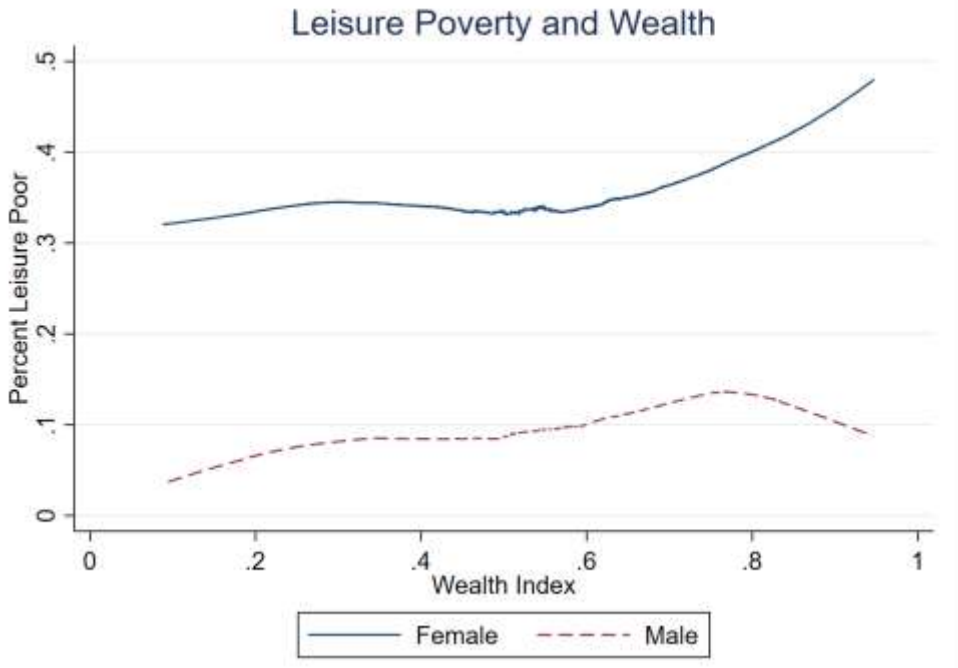


Figure 7: Incidence of leisure poverty by wealth, Peru

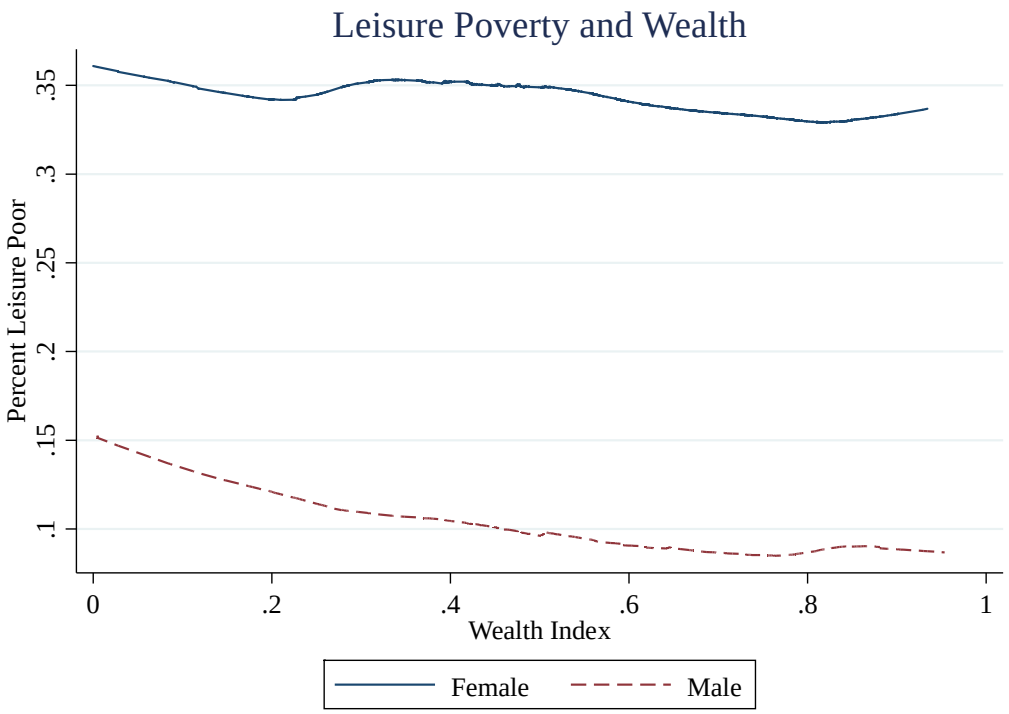
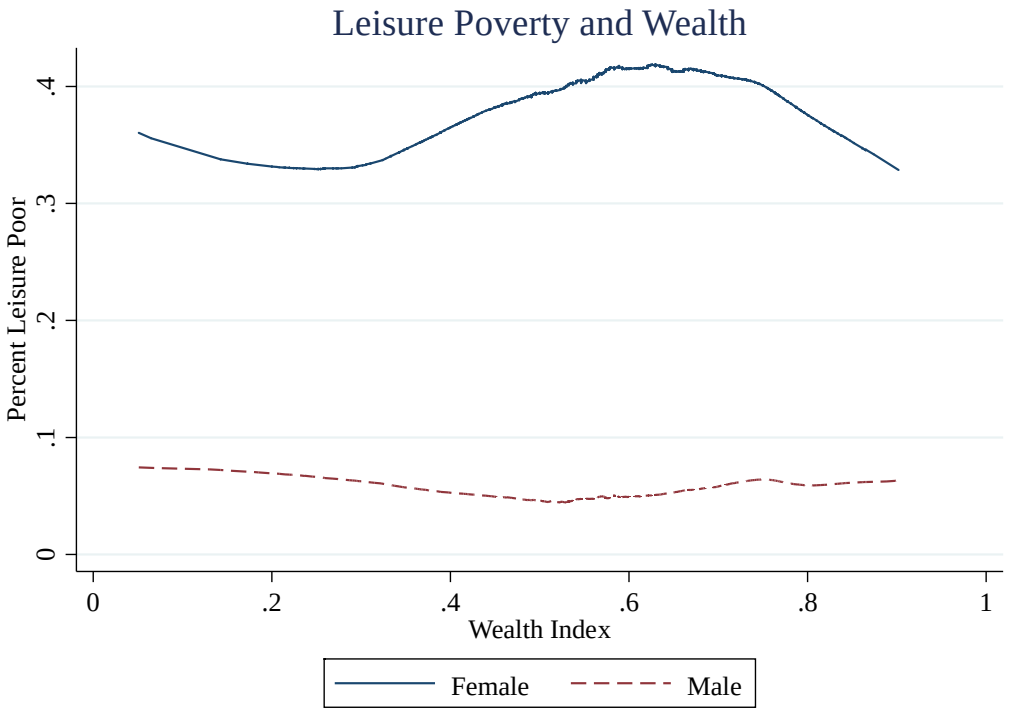


Figure 8: Incidence of leisure poverty by wealth, Vietnam



Tables

Table 1: Average time use in hours (Round 4)

	Education	Work	Play	Sleep
Ethiopia N=3,970	6.13 (3.07)	4.08 (2.64)	4.31 (2.60)	9.46 (1.22)
India N=3,853	9.51 (2.66)	1.27 (2.09)	4.22 (1.74)	9.00 (0.88)
Peru N=4,488	7.73 (2.11)	2.39 (2.21)	4.19 (1.85)	9.69 (1.20)
Vietnam N=3,573	7.76 (2.79)	1.85 (2.39)	5.32 (2.30)	9.06 (1.09)
Notes: Standard deviations in parentheses.				

Table 2: Inequality in Time Use (Round 4)

	Ethiopia				India			
	Study	Work	Play	Sleep	Study	Work	Play	Sleep
Total	0.125	0.155	0.182	0.009	0.039	1.35	0.085	0.005
Between	0.067	0.113	0.077	0.005	0.023	0.637	0.056	0.0015
Within	0.058	0.042	0.105	0.004	0.016	0.710	0.029	0.0031
(%) Within	47%	43%	58%	44%	41%	53%	35%	33%

	Peru				Vietnam			
	Study	Work	Play	Sleep	Study	Work	Play	Sleep
Total	0.037	0.432	0.097	0.007	0.064	0.832	0.094	0.007
Between	0.020	0.212	0.052	0.004	0.041	0.455	0.063	0.005
Within	0.017	0.220	0.045	0.003	0.023	0.377	0.031	0.002
(%) Within	47%	51%	47%	45%	36%	45%	33%	30%

Table 3: Intra-household Distribution of Standardized Time-uses, Ethiopia (Round 4)

	Study	Work	Play	Sleep
Female	0.079*	0.039	-0.103**	-0.065
	(0.039)	(0.066)	(0.038)	(0.038)
Age	0.530***	0.277***	-0.731***	-0.376***
	(0.062)	(0.051)	(0.072)	(0.038)
Age Squared	-0.022***	-0.008***	0.029***	0.012***
	(0.002)	(0.002)	(0.003)	(0.002)
Age Rank	-0.195**	-0.021	0.170***	0.173***
	(0.076)	(0.080)	(0.053)	(0.044)
Observations	4,859	4,859	4,859	4,859
Adjusted R^2	0.474	0.472	0.543	0.654
Notes: ***: p<.01; **: p<.05; *: p<0.1.				
Robust standard errors clustered at the level of primary sampling unit				

Table 4: Intra-household Distribution of Standardized Time-uses, India (Round 4)

	Study	Work	Play	Sleep
Female	-0.044	0.175**	-0.097**	-0.093**
	(0.054)	(0.063)	(0.044)	(0.038)
Age	0.408***	-0.111	-0.346***	-0.289***
	(0.087)	(0.074)	(0.077)	(0.081)
Age Squared	-0.020***	0.011***	0.013***	0.008**
	(0.004)	(0.003)	(0.003)	(0.003)
Age Rank	-0.046	-0.077	0.092	0.141*
	(0.100)	(0.101)	(0.060)	(0.074)
Observations	4,081.000	4,081.000	4,081.000	4,081.000
Adjusted R^2	0.278	0.221	0.402	0.549
Notes: ***: p<.01; **: p<.05; *: p<0.1.				
Robust standard errors clustered at the level of primary sampling unit				

Table 5: Intra-household Distribution of Standardized Time-uses, Peru (Round 4)

	Study	Work	Play	Sleep
Female	0.069	0.088*	-0.128***	-0.087*
	(0.041)	(0.044)	(0.038)	(0.047)
Age	0.501***	0.122**	-0.521***	-0.301***
	(0.052)	(0.052)	(0.041)	(0.042)
Age Squared	-0.022***	0.000	0.019***	0.009***
	(0.003)	(0.003)	(0.002)	(0.002)
Age Rank	0.021	-0.133**	0.082	0.084
	(0.081)	(0.052)	(0.067)	(0.060)
Observations	4,285	4,285	4,285	4,285
Adjusted R^2	0.323	0.461	0.553	0.493
Notes: ***: p<.01; **: p<.05; *: p<0.1.				
Robust standard errors clustered at the level of primary sampling unit				

Table 6: Intra-household Distribution of Standardized Time-uses, Vietnam (Round 4)

	Study	Work	Play	Sleep
Female	0.138	0.087	-0.210**	-0.100**
	(0.098)	(0.065)	(0.085)	(0.046)
Age	0.273***	-0.044	-0.165**	-0.252***
	(0.064)	(0.079)	(0.074)	(0.067)
Age Squared	-0.012***	0.006	0.005*	-0.005
	(0.004)	(0.004)	(0.003)	(0.003)
Age Rank	0.183	-0.354***	0.152	-0.015
	(0.138)	(0.113)	(0.109)	(0.068)
Observations	3,511	3,511	3,511	3,511
Adjusted R^2	0.256	0.363	0.366	0.547
Notes: ***: p<.01; **: p<.05; *: p<0.1.				
Robust standard errors clustered at the level of primary sampling unit				

Table 7: Intra-household Distribution of Time-uses, Ethiopia (Round 5)

	Study	Work	Play	Sleep
Female	0.148***	0.036	-0.121*	-0.098*
	(0.043)	(0.068)	(0.058)	(0.051)
Age	0.346***	0.147	-0.494***	-0.423***
	(0.081)	(0.089)	(0.101)	(0.078)
Age Squared	-0.011***	-0.003	0.019***	0.013***
	(0.004)	(0.004)	(0.004)	(0.004)
Age rank	-0.076	-0.032	0.076	0.136
	(0.059)	(0.060)	(0.067)	(0.099)
Observations	3,650	3,650	3,650	3,650
Adjusted R^2	0.457	0.498	0.453	0.605
Notes: ***: p<.01; **: p<.05; *: p<0.1.				
Robust standard errors clustered at the level of primary sampling unit				

Table 8: Intra-household Distribution of Time-uses, India (Round 5)

	Study	Work	Play	Sleep
Female	-0.024	0.124*	-0.093*	-0.099**
	(0.061)	(0.066)	(0.047)	(0.045)
Age	0.364**	-0.097	-0.270**	-0.555***
	(0.154)	(0.146)	(0.114)	(0.154)
Age Squared	-0.017**	0.009	0.010*	0.020***
	(0.006)	(0.006)	(0.005)	(0.007)
Age rank	-0.106	-0.034	0.080	0.349***
	(0.100)	(0.106)	(0.106)	(0.098)
Observations	3,454	3,454	3,454	3,454
Adjusted R^2	0.344	0.353	0.359	0.445
Notes: ***: p<.01; **: p<.05; *: p<0.1.				
Robust standard errors clustered at the level of primary sampling unit				

Table 9: Intra-household Distribution of Time-uses, Peru (Round 5)

	Study	Work	Play	Sleep
Female	0.034	0.112**	-0.129**	-0.068
	(0.069)	(0.050)	(0.052)	(0.040)
Age	0.453***	0.026	-0.445***	-0.243***
	(0.052)	(0.050)	(0.038)	(0.038)
Age Squared	-0.018***	0.003	0.015***	0.007***
	(0.003)	(0.002)	(0.002)	(0.002)
Age rank	0.002	-0.131***	0.090**	0.091*
	(0.056)	(0.038)	(0.041)	(0.051)
Observations	3,910	3,910	3,910	3,910
Adjusted R^2	0.352	0.458	0.496	0.575
Notes: ***: p<.01; **: p<.05; *: p<0.1.				
Robust standard errors clustered at the level of primary sampling unit				

Table 10: Intra-household Distribution of Time-uses, Vietnam (Round 5)

	Study	Work	Play	Sleep
Female	0.227**	0.031	-0.314***	-0.136
	(0.090)	(0.080)	(0.056)	(0.089)
Age	0.093	0.112*	-0.151**	-0.281***
	(0.067)	(0.060)	(0.064)	(0.079)
Age Squared	-0.004	-0.001	0.004	0.007**
	(0.004)	(0.004)	(0.003)	(0.004)
Age rank	0.159	-0.269*	0.071	0.042
	(0.150)	(0.152)	(0.088)	(0.072)
Observations	3,180	3,180	3,180	3,180
Adjusted R^2	0.392	0.433	0.418	0.561
Notes: ***: p<.01; **: p<.05; *: p<0.1.				
Robust standard errors clustered at the level of primary sampling unit				

Appendix

The complementary slackness conditions that characterize the household's problem are:

$$\delta_1 \left(Y + \sum_{i=1}^{N} w(\theta_i) L_i - C \right) = 0 \tag{KT5}$$

$$\delta_{2i}(T - S_i + L_i + H_i) = 0, \forall\, i \tag{KT6}$$

$$\delta_{3i}(L_i) = 0, \forall\, i \tag{KT7}$$

$$\delta_{4i}\left(S_i - \underline{S}\right) = 0, \forall\, i \tag{KT8}$$

$$\delta_{5i}\left(H_i - \underline{H}\right) = 0, \forall\, i \tag{KT9}$$

where δ_1, $\{\delta_{21}, \dots, \delta_{2N}\}$, $\{\delta_{31}, \dots, \delta_{3N}\}$, $\{\delta_{41}, \dots, \delta_{4N}\}$ and $\{\delta_{51}, \dots, \delta_{5N}\}$ are the Lagrange multipliers on constraints 2.1 through 2.5. It is trivial to assume that the first two constraints hold with equality, and thus, $\delta_1 \geq 0$ and $\delta_{2i} \geq 0, \forall\, i$.