MATERNAL EMPLOYMENT TYPE, MATERNAL CARE AND CHILD HEALTH IN RURAL CHINA: POLICY AND BEHAVIOR

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ABSTRACT

JIANFENG YAO: Maternal Employment Type, Maternal Care and Child Health in Rural China: Policy and Behavior
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How a mother's labor market activities and child care arrangement affect children's health is an especially important subject for China. From the perspective of a rural woman's two-fold identity in the family as an income earner and childcare giver, the effect of the change in her work patterns and child care supply behaviors on child development has added an element of uncertainty. In rural areas, we are not sure which is more important in determining child health, family income and social status or maternal child care or unobserved heterogeneities such as culture, eating habits and other preferences of living. Driven to answer this question, we have studied the labor supply patterns of women who are engaged in various working sectors in rural areas of China where the rural population primarily relies on non-medical choices to improve their health. We discuss women's participation in labor and its long-term effect on children's health outcomes.

Using the China Health and Nutritional Survey, we developed a dynamic model of rural women's agricultural, nonagricultural, and migratory labor supply behavior and their associated decisions related to child care arrangement. The Discrete Factor Random Effects has enabled us to perform a joint estimation of the dynamic effects of maternal employment types and associated maternal care decisions of rural women on the demand for nutritional inputs for children and child health production. Implications of policies about labor migration, food subsidy, child care subsidy and health care reform are reflected in these effects.

We find that labor-intensive nonagricultural and migratory employment lead to a decrease in overall child health relative to home production. However, subsidies to reduce food price and medical care cost will decrease the odds of maternal nonagricultural work and increase mothers' willingness to spend more time in childcare, and rural children's health will be consequently improved. In addition, small wage increases in the nonagricultural sector will actually worsen child health conditions as the income effect reinforces the substitution effect. Overall, In order to effectively improve the child health in rural areas, maternal employment and childcare decisions should be considered carefully when formulating public policies.

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CHAPTER 1 INTRODUCTION

How a mother's market activities affect the time she spends taking care of her child and thus her decisions for child health production is an important question for any society or economy. It is especially important for a country like China where a woman's participation in the labor force is highly regarded in the society and is thus of prime importance to a woman herself. It is also a country where the female labor force participation rate (72.4%) is one of the highest in the world (United Nations, 2000).

The discussion of this question is significant especially at a time when many developing countries are going through reforms that bring in structural transformation of their economies by reducing the dominance of agricultural sector and creating more manufacturing and service sector jobs. For example, using a Household Survey data from Guinea, Glick & Sahn (1998) find that, as industrialization progresses, more informal sector jobs replace agricultural jobs and increased working hours for the mothers reduce child's nutritional status (even with self-employment where mothers could accommodate child's need even when at work).

The economic reforms pursued by China have resulted in an expansion of the Chinese labor market and especially the rural labor market. In recent years, China has put more weights on the investment in large projects such as urban development and entrepreneurships. These projects are often short-term compared with other long-term investments in social security system and health care reforms, As a result, cities have expanded, the number of industrial firms has increased, and a dramatic economic growth and structural change is observed. The structural change in the rural labor market was more noticeable in the sense that more workers switched from farm work to off-farm

employment (China Yearbook, 2005). This off-farm employment in some rural areas was created partly by the growth of the light industrial sector (due to the encouragement by the Chinese government for private enterprise) which was more suitable for less skilled rural female workers and this resulted in rural-to-rural/farm-nonfarm migration. The economic growth also resulted in rural-urban migration. As Zhang, DeBrauw & Rozelle (2004) point out, in both cases of farm-nonfarm and rural-urban migration, female rural workers' participation was larger than that of men and younger female workers exceeded the participation rate of other cohorts among women.

In countries like China, India and developing countries of Africa, mothers are primarily responsible for providing childcare in the family. Usually female farm workers find that they can accommodate childcare while they are working on the farm. As structural changes in the Chinese economy transformed the female rural labor market from farm work to non-farm work, rural female workers started focusing more on the nonagricultural work or migrated to the urban areas. Consequently, as primary childcare providers within the family, mothers started to face time constraints that generated many potential conflicts between market employment behaviors and non-market activities such as cooking, cleaning and caring for the child. Not only working mothers had to manage with less time available to take care of their child (maternal care time), care quality might have been lowered because of work-related stress and exhaustion (Desai, *et al*., 1989). The formal or informal substitutes for maternal care such as childcare centers, babysitters, relatives or older children, even if are available, may not be affordable or may not guarantee quality care in rural areas (Glick and Sahn, 1998; McGuire and Popkin, 1990). Fathers in the family affect child welfare mainly through their income (making it affordable to consume more). In almost all developing countries, fathers in the family engage less in childcare activities than do mothers (especially for young children. Evans,

1995). Thus, from these developing countries' perspective, the impact of women's work life on child development has more important policy implications than the impact of men's work on child development.

Even when the growth of nonagricultural sector creates better employment opportunities for rural women and brings economic relief to their families by boosting family income, it may have negative impact on the health outcome of the child. The negative outcome may have worked through the absence of sufficient maternal childcare time and quality childcare that could have been provided by the mother if she didn't work. In addition, nonagricultural employment that involves rural-urban migration of the mother creates the problem of leaving the child behind in the rural sector and gives rise to a special group of children called "left behind children."

A mother's labor force participation affects maternal care and the health of the child over a period of time and all three of them may be affected by some other conditions of the past and the present. These can have effects on the present and future behavior pattern of a mother through the health condition of the child in the past, mother's childcare time in the previous period, health shocks and other exogenous shocks like price and wage shocks. The change in mother's behavior affects mother's childcare time as well as her demand/use of nutritional intake for her child. The working mother may tend to use more inputs towards health production of the child at a later date. Thus a dynamic model that includes the effects of the past conditions and behavior, unobserved time varying and time independent heterogeneity can better explain the outcome (Yang, Gilleskie and Norton, 2009).

Using the China Health and Nutritional Survey and a dynamic model, we estimate jointly a system of equations representing mother's work time, childcare time, health shocks to the child, mother's income and health production. We also include both time

varying and time independent unobserved heterogeneity. This allows us to estimate the dynamic effects of employment decision (agricultural, nonagricultural and migratory employment or wage and nonwage employment) and associated maternal care decisions of rural women on the demand for nutritional inputs for children and child health production through the usage of those nutritional inputs. Our discussion also underscores the significance of different reform policies pursued by the Chinese government, e.g., New Health Initiative of Five Year Plan, New Rural Cooperative Medical Care System in Rural China and the Policy of Urbanization that affected land use, employment in factories, conditions of roads and rural to urban transportation system. This study has to six sections. The introduction is followed by background, theoretical model and estimation strategies. The fourth part is data description and analyses. Finally, a discussion of the estimation results, conclusions, and policy implications and simulation end the paper.

CHAPTER 2 LITERATURE REVIEW

Maternal Employment and Child Health

The health economics literature has already recognized the link between maternal work and child health and welfare. However, we see more studies (focusing on the issue) from the developed countries' perspectives, most probably, because easily accessible data are available for these countries. For example, Gordon et al. (2007) measure the effects of maternal employment (and non-maternal childcare) on child injuries and infectious diseases for children aged 12 - 36 months by a fixed effect strategy, but no statistically significant effects of maternal employment are found. Gennetian *et al*. (2010) identify the effects of low-income mothers' employment on the health of young children by exploiting a welfare-to-work experiment, the National Evaluation of Welfare-to-Work Strategies (NEWWS). They find that, among the low-income children in the sample, maternal employment decreases a child's probability of being in good or excellent health by a modest amount. Ruhm (2008) uses the National Longitudinal Survey of Youth (NLSY) to analyze the effect of maternal employment on a cohort of children aged ten and eleven, employing a fixed effects strategy to control for fixed mother and family characteristics. Ruhm finds large differences in effects based on the child's socioeconomic status (and other proxies for disadvantage), such that disadvantaged children see no effect or benefit from maternal employment, and advantaged children experience harmful consequences.

Baker *et al*. (2008) estimate the effect of the maternal labor supply on young children's health by examining the impact of a local childcare subsidy program in Quebec in the late 1990s. Using a difference-in-differences identification strategy, they conclude that the policy led to an increase in maternal labor, an increase in formal childcare

enrollment, and a decline in children's health. The authors consider the impact of the childcare subsidy program only on eligible children and do not separate the direct effect of childcare enrollment from the effect of maternal employment.

In the context of the developing countries, using China Health and Nutrition Survey data for a static model, Liu (2008) analyzes the effects of maternal labor supply on children's health outcomes in rural China. With data from the China Health and Nutrition Survey (CHNS) and a static model, Liu finds that that an increase in mothers' working hours reduces the time available for children and has a negative effect on children's health across the sample, while the additional income generated contributes to improving child's nutritional status. With the working time effect's outweighing the income's effect, maternal work overall has a small negative effect on children's health, and the effect is more pronounced for nonagricultural work than for agricultural work. These results suggest that economic structural changes have intensified the conflict of women's dual identity as income earners and as caregivers. While Liu's single-equation static model can't take care of the endogeneity bias and the dynamics involved in maternal employment, childcare time and child health production, we manipulated the longitudinal structure of the CHNS in order to estimate a more reasonable dynamic model across time and individuals and so we could observe how much variation in children's health can be explained by maternal care time, job change, and nutritional inputs over several years.

Work-related Migration and Left-behind Children

With a growing number of children left behind and living in under-developed rural areas, separated from one or both of their parents, impacts on these children's physical, psychological, behavioral, and health conditions are expected. Left-behind children are usually taken care of by their relatives or grandparents. There are two different

viewpoints with respect to this issue. The first group of researchers argues that, when parental care is not available, grandparents may provide family love and security that is more favorable than parental care to child development (Bert *et al*., 2005). Solomon *et al*. (2005) uses data from the United States to conclude that there is no significant difference between the health status of children raised by their relatives and those raised by their biological parents. However, other researchers argue that most grandparents are relatively advanced in age and have low education and poor health, so they do not always have sufficient physical or financial resources for childcare, and the child's physical condition is likely to be negatively affected (Gaudin *et al*., 1993; Kirby *et al*., 2002). Matthew *et al*. (2000) find that children who live with their parents are generally healthier than those that do not, after controlling for individual socioeconomic factors.

By measuring the effect of childcare quality, Currie and Hotz (2004) suggest the important role of supervision in avoiding accidents, sickness, and injuries among young children. They find that the incidence of unintentional injury of children under age five is reduced in states with more stringent childcare regulations. In related work, Aizer (2004) shows that after-school supervision of adolescents aged from ten to fourteen has a strong effect on their well-being, as measured by criminal activity and behavior problems[1]. Aizer uses a sample from the National Longitudinal Survey of Youth (NLSY) to estimate several fixed effects models using variation in supervision between and within families. If children with mothers who work spend more time unsupervised, they may have a higher risk of accident or injury, which may lead to additional hospitalizations.

Few econometric analyses have been done in the studies conducted by Chinese researchers. Although most studies argue for an ambiguous effect of family structure on

[1] These two articles indicate that a parent's presence and supervision have positive effects on children's behaviors that are favorable to their health from a very young age through adolescence. However, in developing countries with patrilineal societies, such as China, "parent" usually refers to the mother because the bond between a mother and her child is tighter than the attachment between a child and her father or any other family members.

children's health, farmers in underdeveloped villages have lower income and lack access to quality medical facilities; therefore, the health condition of their children left behind is more vulnerable to family structure. Using CHNS data from 2000 to 2006, Chen (2009) analyzes the health status of the left-behind children in rural China, based on the height-for-age Z score (HAZ) and body mass index (BMI). The results show that the left-behind children from zero to five years old have the same health status as those who live with two biological parents and that their health is dependent on household income and access to medical systems. However, the left-behind children from six to eighteen years old have poorer health than those who live with their parents. Focusing on the left-behind children over five years old who live without mothers, Chen finds that the negative effect of a shortage of maternal care on a child's health is pronounced for both low-income families and high-income families. Therefore, it is important for adolescent development that household income and maternal care time both be increased in order to improve children's health. However, the endogenous maternal care time and maternal income are not instrumented in his single equation estimation, sources affecting maternal care (i.e. maternal work type) are not identified, and the treatment effect to take care of the selection bias is not performed. Thus, the static reduced form and/or single equation estimates may not have shown the actual relation between maternal work and child health production, and therefore, estimation results are questionable.

Review of Policies: Urbanization

The ninth and tenth 5-year plans of China (from 1996 to 2005) have 3 focuses: 1. Speeding up the establishment of a modern enterprise system; 2. Increasing the number of urban employees and number of surplus rural laborers transferred to the cities, thereby controlling registered urban unemployment rates; And 3. Bring the development disparity between regions under effective control and raising levels of urbanization. Therefore, the

weights that are put onto urbanization by the Chinese government are quite high and there are associated consequences toward child health in rural areas. Few people realize that urbanization might have an impact on child health in China or the fact that such urbanization might influence child health by altering mothers' labor supply behaviors. Poel et al. (2009) examine the impact of rapid urbanization in China on individuals from 20-45 years old. Their results reveal robust and negative casual effects on health self-reported health. It is argued that, while people in more urbanized areas are, on average, healthier than those in rural areas, the process of urbanization has adverse effects to one's health. In another study, Poel et al. (2008) confirm that chronic health conditions that are associated with modernization and affluence, such as obesity and hypertension, are becoming an urgent problem in China as development and urbanization are spreading within the eastern and central provinces of China; this also applies to diseases of affluence.

Review of Policies: Health Care

The New Rural Co-operative Medical Care System (NRCMCS) was introduced in 2002 to overhaul the healthcare system and aimed at affordable health care for the rural poor. In cities, so-called permanent urban population (except migrants defined as people working in cities) take out medical insurance. However, the poor, many of them in the rural areas, go into debt to pay their medical bills for catastrophic symptoms or most people go without treatment. Many in rural areas struggle to afford the new burden of healthcare fees, which is the result of the collapse of the old state-funded health system that existed before China's program of economic reforms in the 1980s (Dib et. al. 2008). After paying a fixed annual fee under this NRCMCS, an individual's medical bill will be covered under this scheme; however, the percentage of coverage varies by locations.

China has no national primary care system, or so-called general practice. The

introduction of general practice in some provinces in China began in 1999. General practice has been slowly accepted due to the background of a tradition of hospitals as primary care providers; the common belief that specialists are more skilled than generalists, even for minor symptoms, and the rights of the individual to use the provider of their choice. However, these attitudes are changing slowly. In several provinces, such as *Zhejiang*, *Jiangsu*, and *Guangdong*, generalists are acquiring a good local reputation and attracting large numbers of patients (Liu et al., 1996). However, there are several important problems associated with such a health care system in China. For example, this system keeps basic wages low; however, allows doctors to make money from prescriptions and investigations that lead to perverse incentives, inefficiencies, and lower quality of care. Bredenkamp (2008) finds that quality of care, as measured by waiting time, and accessibility to healthcare, as measured by travel time, is positively associated with child nutritional status, however, in a favored model, with income being instrumented, the significance of such effects goes away. Without taking into account the maternal childcare supply behavior change, due to such policy, the estimation is likely to be biased.

Review of Policies: Food Price

Price regulation, as a measure of administrative and economic intervention, is usually adopted by Chinese Government as its growing population must be fed by decreasing food production resources (such as land and water) and rising domestic food production costs and opportunity costs of labor. Food supply and price are crucial in China as rapid industrialization has led to population growth and income, fast urbanization and competition between agricultural and nonagricultural sectors for resources.

It is interesting to observe that, in rural parts of China, people have poor nutrition

because agricultural products can have a decent price and are often sold rather than kept for personal consumption. It is common in China that rural families do not consume eggs that their hens lay, rather sell them at the market. The money earned is then spent on low quality food, such as instant noodles, which lack nutritional value compared to an egg. It is also common that some children only have a bowl of pork once every five to six weeks, while urban children have a vast array of food chains from which to choose from[2].

Guo *et al.* (1999) investigate the impact of food prices on the consumption of macronutrients based a sample of adults from 20-45 years old. The effect shows large and significant price effects. By dividing people by income levels and examining the price elasticity of three commonly eaten foods: pork, eggs and oils, significant effects of various food prices are found to decrease fat intake of the rich, but do not adversely influence the protein consumption for the poor. The results show that increases in the prices of pork, eggs, and oils are predicted to lower fat intake and only increases in pork prices lead to reduced protein intake. However, Guo *et al.* ignore a couple of important factors. First, there is huge disparity of nutrition consumption behaviors between urban and rural households. As mentioned above, people in rural areas are not only consumers but also producers. Second, nutrition consumption patterns are different between the young and married adults. In China, it is commonly observed that the nutrition consumption priority for married household firstly comes to children, then elderly (if there is any), and finally the parents. It is the caregiver (usually mother) who determines the amount of nutritional inputs of her children or family members.

[2] A survey conducted by China's Ministry of Health showed the kind of food consumed by rural households. 30 percent consume meat less than once a month. 23 percent consume rice or egg less than once a month. Up to 81 percent consume less than one cup of dairy products a week. Dairy products and eggs provide essential nutrients that are important for a child's physical development.

CHAPTER 3 THEORETICAL FRAMEWORK

In this section, we present a theoretical model of how a rural mother makes her decisions regarding work types (agricultural/nonagricultural/migratory work), childcare time and associated child health/nutritional inputs[3]. Given a set of state variables and predetermined variables realized at the beginning of period *t*, such as local community characteristics, mothers' previous decisions, child's health status entering the period (lagged health) and maternal demographic characteristics, we model a pathway through which a mother's labor force participation and childcare decisions may affect child health.[4] In our theoretical model, we assume that each family has only one child due to the one child policy imposed by the government[5]. We also assume that the employment decisions of other family members (such as fathers and grandparents) do not affect child health.

At the beginning of time *t*, a typical rural Chinese mother makes decisions with regard to alternative work types (agricultural/nonagricultural), associated workplaces (rural/urban) and the time spent in childcare (WT_t and CHT_t) to maximize her expected lifetime utility.

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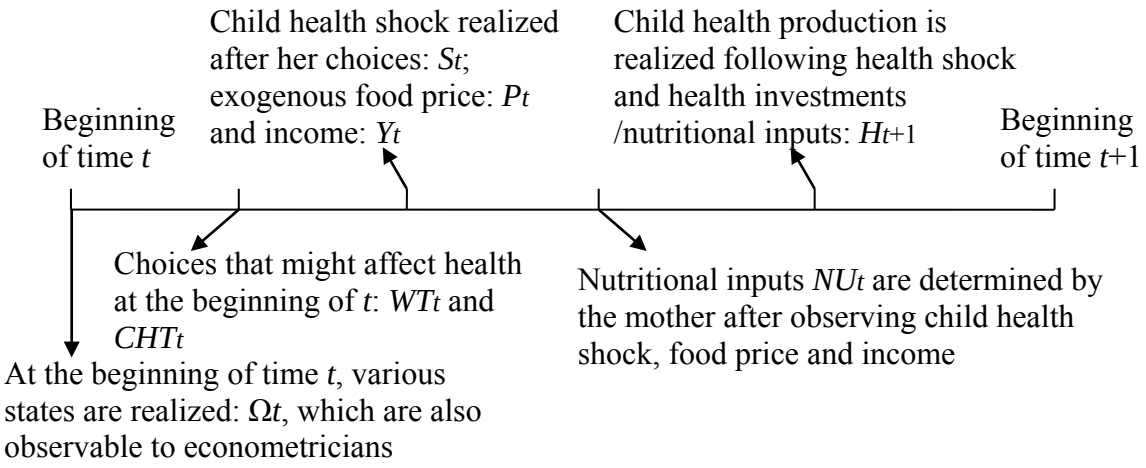
[3] In a typical Chinese family, mother, as a care giver, makes decisions about child's nutritional inputs.

[4] In our data set the time horizon for this dynamic process covers roughly 11 years from when the child is three years of age and until the child is 18. To keep the model simple we don't include fertility decision which may be influenced by "one child" policy not observed in the data. Young children start going to private or public daycare center when they are about three years old. After finishing government mandated education level they either go to college or land a job when they are 18.

[5] Although 40% of our sample has more than one child, a Chinese family usually opts for a second child only if the first child is not a male and even with multiple children most of the family resources are used for the wellbeing of the male child (youngest one). Sons are preferred to daughters in the developing countries because they, unlike daughters, don't assume another name after they are married and they are assumed to provide economic security when parents are old.



Each type of work is characterized by a specific location, for example, if a mother chooses an agricultural work, she is only able to engage in such work in her village. However, if she chooses a nonagricultural work, she then has the options of either working locally or commuting to another nearby town or going to cities and leaving her child behind[6]. Jointly with her work type choices, this individual also makes a decision on how much time to spend in taking care of her child[7]. These choices of employment types and childcare time in each period depend on the previous period's information (Ω_t) which includes child's overall health outcome (nutritional outcome), maternal choices in the last period, in addition to other exogenous variables. After choosing a type of work and childcare time, the mother's current income offer (Y_t), child health shock (S_t;)[8] and

[6] We assume that, once the individual chooses to work in the city, she has to leave her child behind given the fact that most cities in china imposed barriers to entry to prevent the city from being over-populated. This is also observed in our data.

[7] This decision making process is typical to Chinese women. In a qualitative survey (described and used in Short, Fengying, Siyuan and Mingliang, 2001) conducted after the quantitative survey of CHNS, almost all women in rural areas give their jobs the priority choice. They decide on childcare time after deciding on the work choice.

[8] We define two types of health shock following our data: 1. General health shocks; 2. Health shocks due to malnutrition. The general health shocks are associated with acute symptoms. The survey questions we look at for general health shocks are "has the child been sick in the past 4 weeks, did he get fever, diarrhea, asthma, heart disease or other non-communicable diseases?" We use these symptoms directly in the model on the assumption that these would have negative impact on the overall health. We also use two indices to measure malnutrition or faulty nutrition called systolic and diastolic pressure. About 30% of the children in the sample have low blood pressure and heart problems. It makes the tissues forming the walls of the blood vessels over-relaxed, and flabby or stretched. This results in less supply of oxygen and nutrients to the tissues. Malnutrition can result from a diet deficient in calories, proteins, vitamin B or C.

exogenous food price (P_t) can be observed. After evaluating the food price and child health shock and her income offers, the mother then chooses how much nutrition to put into her child[9]. Finally, at the end of the period, given the mother's choices and other exogenous/endogenous information, a child's overall health status or nutritional status is achieved.

Specification of Choice and State Variables

We categorize the mother's work type, WT_t, according to work load intensity and childcare arrangement compatibility (based on whether it is difficult to combine childcare and work). It suggests time flexibility and work location (rural/urban) is embedded in the type of the work. Following Short et, al (2002) we classify the work types as follows: 0: no work; 1: nonwage work (defined as agricultural work which is most compatible with childcare) in village; 2: wage work (defined as nonagricultural work which is less compatible with childcare[10]) in village or neighboring village; 3: a mixture of wage and nonwage work (defined as both agricultural work and nonagricultural work); 4: wage work elsewhere most probably in a city (defined as migratory work which is least compatible with childcare)[11]. We also assume that work intensities are similar among occupations within the same type of work.

We classify childcare time, CHT_t, in four categories. In response to the question whether a mother decides about the childcare time before the health shock, China Health and Nutrition Survey (CHNS) documents two kinds of maternal care time: childcare

[9] We have nutrition and food intake information in CHNS. Traditionally Chinese people believe that taking good care of children means feeding them well. We assume that as a care giver, mother is in charge of her child's food intake. Mothers' behavior in a typical Chinese family supports this assumption. In our model nutritional input choice is made after the realization of "endogenous health shock" and "food price shock". Therefore, this choice is associated with the health shock and food price shock and can't be made in the beginning with other choices.

[10] Wage worker can still provide high childcare time by scarifying her leisure time.

[11] This measurement is more like a categorical measurement. We are trying to predict the probabilities of the different possible outcomes of a categorically distributed dependent variable (work type choice), given a set of independent variables.

$$WT_t = \begin{cases} 0 \text{ no work} \\ 1 \text{ nonwage work (agricultural work) in village} \\ 2 \text{ wage work (nonagricultural work) in village} \\ 3 \text{ both wage and nonwage work in village} \\ 4 \text{ wage work else where (in town, city)} \end{cases}$$

hours spent during the last week and childcare hours spent on average over a year. The response to the survey question combines childcare time with the household chore time. Last week's childcare time may not be accurate to capture the average time spent in childcare because a child may be in an accident or parents may be busy and out of town last week (e.g. taking care of grandparents, dealing with family and work emergencies, which are not observable). More importantly we want to examine the effect of chosen childcare time on the variation of a child's overall health over a time period (from *t* to *t*+1). We use the yearly average maternal care time mixed with the household chore time (such as cooking time, food buying time, clothes washing time and house cleaning time) to indicate the time spent in childcare on the assumption that taking care of a child includes preparing food for the child, washing for the child etc. Thus we group childcare time into extremely low (less than an hour), low (between one and three hours), moderate (between three and five hours) and high category (over five hours).

$$CHT_t = \begin{cases} 0 \text{ none/extremly low} \\ 1 \text{ low} \\ 2 \text{ moderate} \\ 3 \text{ high} \end{cases}$$

As for the health shock, we use the response to the question whether a child were sick or injured during the last four weeks or whether the child had any type of symptom of illness associated with lack of nutrition. This child's health shock, S_t, is defined as a typical dichotomous variable with 0 having no shock and 1 otherwise. We incorporate the

health shock in our analysis because the health shock does affect the current nutritional inputs and overall health outcomes. Following the work type and childcare time choice, maternal income, Y_t, (CPI adjusted income) is observed. In addition, we also use food prices information of the community survey of CHNS to indicate the exogenous food price factor, P_t, that may affect nutritional input decision. Given their definitions, both Y_t, and P_t are continuous in our model.

After the realization of maternal income, price shock and child health shock, the mother then decides on the nutritional inputs, NU_t. We used average carbohydrate, fat, protein and energy that a child consumed over the past month as nutritional inputs. The nutritional input levels are in terms of continuous z-scores and also adjusted for age and community.

The last item on our time path is a child's overall health outcome for which we use Height-for-age Z-score or HAZ (to indicate a child's health/growth status) based on the standards from WHO. In the simulation test, we also add self-reported health status (discrete) for the robustness check. The HAZ measure has been cited as a one good measure of child health status and as good as self-reported health (Rieger and Wagner (2011), Aslam and Kingdon (2010), Chen and Li (2006), etc).[12]

Utility Function

The current utility function, given the mother's choice, is given by:

$$U_{it}\left(C_{it}, WT_{it}, CHT_{it}, NU_{it}, H_{it}, L_{it}; CM_{it}, X_{it}^{m}, X_{it}^{c}, \mu_i, \varepsilon_{it}\right) \quad (1)$$

We assume that, within each time period t, the determinants of mother's per-period utility include her own consumption (C_{it}), her work type (WT_t) and childcare

[12] We are interested in the health dynamics, and dynamics of mother's job change on children's health transitions, and we are looking at the variance within China (respondent are all of Chinese origin) and problems such as genes affecting height can be ignored. We have used both discrete and continuous z-scores. For the discrete HAZ, it is defined the same as self-reported health status with 1 being excellent and 4 being poor. Cut-off points are chosen based on the number of standard deviations from the WHO's (World Health Organization) reference height.

time (CHT_t). This mother also cares about her child's health status at the beginning of t or lagged child health (H_{it}). In addition, leisure (L_{it}), exogenous community characteristics (CM_{it}), and socio-demographic characteristics (X_{it}) are assumed to affect this woman's per period utility. Finally, this mother's unobserved preferences for employment and maternal care are included in the unobserved permanent and time-variant heterogeneity.

Later on, this woman's per period consumption (C_{it}) is captured by the budget constraint that is determined by family income, government transfer and food expenditure:

$$C_{it} = Y_{it} + Y_{it}^{f}\left(X_{it}^{f}, CM_{it}\right) + G_{it} - P_{it}^{nu} NU_{it} \quad . \tag{2}$$

Because the rural woman has to face the tradeoff between work and childcare, another important constraint comes from time. We assume that the mother is endowed with a fixed amount of time that she uses to provide maternal care (CHT_{it}), labor (HR_{it}), leisure or nonmarket activity (L_{it}) that includes time spent on taking care of the elderly in the household, visiting relatives, etc.:

$$T = CHT_{it} + HR_{it}\left(WT_{it}, CM_{it}\right) + L_{it}\,. \tag{3}$$

During each time period t, the lagged child health (H_{it}) enters into mother's utility function to reveal the fact that child overall health state does directly affect mother's utility. Within the budget constraint, Y_{it} is the mother's average annual income, and Y_{it}^{f} is the father's average yearly income that is assumed to be independent upon mother's choices and child health. Therefore, I don't model father's income and assume this income is strictly determined by the demographic feathers and community labor market characteristics. The unearned income or the government support and transfer, G_{it}, may include one child subsidy, job training subsidy, food price subsidy, health care subsidy, etc. We include G_{it} so that we can evaluate the effect of certain government policies on maternal choices and child health outcomes. $P_{it}^{nu} NU_{it}$ represents the food/nutrition expenditure on the child. This expenditure may include expenses on appropriate nutrition

that affect child's morbidity when the household cannot afford to go to see doctors. As the standard procedure, the mother also obtains utility from leisure or other non-market activities, L_{it}. Socio-demographic features of the mother (X_{it}^{m}) such as height, weight, age, education level, and community-level attributes (CM_{it}) such as the population size in the neighborhood and labor market condition in the community also enter into this woman's per period utility function[13]. ε_{it} and μ_i are an alternative-specific random taste components

Child Health Shock

Child's health shock, S_{it}, in our model is defined as the health shock that is responsible for the child's overall health.

$$S_{it} = S\left(CHT_{it}, H_{it}, NU_{it-1}; CM_{it}, X_{it}^{m}, X_{it}^{c}, \mu_i, \varepsilon_{it}\right) \quad (4)$$

Factors affecting the onset of health shock include maternal childcare time, child health outcome realized at the end of the last period, amount of the nutrition receive from mother during the last period and other exogenous variables that incorporate mother's and child's demographic features and community characteristics such as the availability of health care facilities or childcare facilities around and the availability of relatives/grandparents living in the neighborhood to take care of the child. Unobserved child characteristics such as child inherent health are also treated as predictor of health shock.

Child's Overall Heath

In theory, child overall health is indicated by her health stock, and health stock of the child is not observed and is uncertain until the next decision horizon. Note that the latent health stock here at time $t+1$ is related to the health capital of Grossman (1972). Modeling Grossman's health capital, H_{it+1}, would require a reliance on H_{it}. Since both

[13] In the empirical model, for the identification purpose we will describe more specifically different types of exogenous variables affecting different choices.

H_{it+1} and H_{it} are not observed, such a model would be problematic to estimate. In this study, we use an observed ordinal health index, Height-for-age Z-score (HAZ), instead, to indicate the relative child health stock. Also, for the purpose of robustness check, based on the child survey of CHNS, another measure, self-reported health status, is used to calculate a child's likelihood of being at different health states. This latent health depends on present child nutritional inputs, NU_{it}, amount of care time received from the mother, CHT_{it}, current health shock, S_{it}, some community-level exogenous variables and child demographic feathers, X_{it}^{c}, such as age, gender and education (e.g. a more educated child may have a better knowledge of health issues and thereby may refrain from activities that are harmful to his health). In addition, a mother's characteristics, X_{it}^{m}, such as education and age (e.g. a child in a well-educated family may obtain better health in general), may also play important roles in predicting her child's health. Finally, there might also exist certain unobserved psychological and physical effects on the child health, for example, the mother might have unobserved depression and child might be predisposed to the poor health.

$$H_{it+1} = H\left(CHT_{it}, H_{it}, NU_{it}, S_{it}, CM_{it}, X_{it}^{m}, X_{it}^{c}, \mu_i, \varepsilon_{it}\right) \tag{5}$$

μ_i is treated as the unobserved permanent heterogeneity in child, such as cultural and genetic factor that does not vary over time and ε_{it} is the time variant heterogeneity such as child's habits, preferences physical or emotional well beings that change over time.

Maternal Income

$$Y_{it} = Y\left(WT_{it}, H_{it}; CM_{it}, X_{it}^{m}, X_{it}^{c}, \mu_i, \varepsilon_{it}\right) \tag{6}$$

Mother's current income is a function of her employment decision at the beginning of the period *t*, her own job-related characteristics including educational attainment and age (X_{it}^{m}) and unobserved time invariant/variant heterogeneity that

captures mother's ability or skill endowment (μ_i, ε_{it}). In this particular context, the mother's previous employment decision is assumed to affect her current employment decision through the channel of work experience. Similarly, this woman's previous childcare time choice influences her current work decision through affecting the cost of job search/switch. For example, if the mother previously spent more time in childcare, the quantity and quality of job search effort will likely be affected. In our assumption, a typical rural woman is not able to choose to work part-time for low-income jobs, therefore, her child's health is assumed to have an impact on her income through her efficiency or quality of work instead of the working time.[14] CM_{it} represents the labor market condition variables, such as urban/rural average female wage rate, unemployment rate and some other policy related factors.

In general, this functional form captures the fact that maternal work type reflects the mother's income because of the wage differentials among different types of employment (e.g., agricultural versus nonagricultural sectors).[15] Also, the effect of home production is also incorporated in this functional structure. That is, when a mother stays at home, she may be self-employed or engage in home production activities to substitute income she would have earned if she could work.

Maternal Working Time

With regard to the low income jobs, especially the nonagricultural jobs for rural labor force, women's working hour is assumed strictly determined by the type of work they choose in China. That is to say, for these low-skilled jobs, women can't choose part time labor force participation because if they choose to so they may bear the risk of losing

[14] Once a mother decides about work type, working hours choice is embedded in that choice. No working hour flexibility is allowed.

[15] We do not use father's income because in China mother's participation in the work force is decided not by family income or wealth but by the cultural and sociological preference for women's participation in the labor force.

the job and replaced by other substitutes. Therefore, maternal working time is captures by the following structure.

$$HR_{it} = HR(WT_{it}, CM_{it}) \tag{7}$$

In our theory, for low-income workers, there are no random components in the working time function. Other than work type, local labor market conditions, such as job characteristics at time *t*, and other community attributes (CM_{it}) , are assumed to affect working time.

Evolution of State Variables

Based on the timing assumption and decision making process we presented for rural women, at the beginning of the period *t*, the state space of the model is

$$\Omega_t = (CHT_{t-1}, WT_{t-1}, S_{t-1}, Y_{t-1}, NU_{t-1}, H_t, P_{it}^{nu}, X_t^m, X_t^f, X_t^c, CM_t, G_t, \mu_i, \varepsilon_{it})$$

Each combination of a mother and child has a set of individual specific variables that stay fixed or evolve exogenously over time. In the above information set, these variables include observed individual characteristics X_t (age, sex, education) at the beginning of time *t*, exogenous community variables (local wage rate, local infrastructures, population, health facilities, etc.), CM_t, exogenous food/nutrition prices, P_{it}^{nu}, and government subsidies/transfers, G_t.

The optimization problem is set in a dynamic programming framework. Based our timing assumption, given the information that she obtained at the beginning of time *t* (within the information set), the mother first makes the decisions regarding her work type and location, WT_t, and her childcare time, CHT_t, and then determines child nutritional input, NU_t, such that she maximizes the expected value of present discounted utility subject to her time and budget constraints. Therefore, the value function can be written as the maximum over alternative specific value functions, each of which follows the Bellman equation. To solve the maximization problem, the mother has to perform the

backward induction, that is to say, within each time period, he has to firstly choose the child nutritional input to maximize the expected lifetime utility for each bundle of work type and childcare choice, then work type and childcare decisions are made to maximize the overall expected lifetime utility. So, Before the child turns 18 years old, the mother's value function, given her choice over alternative work types and childcare time, can be described as the following:

If we assume health outcome as a discrete variable, then when the child is less than 18 years old, we have the following work type and childcare time alternative-specific value function:

$$V_{wt,cht}(\Omega_{it},\mu_i,\varepsilon_{it})$$
$$= \mathrm{E}\max_{nu\in NU} U\left(Y_{it} + Y_{it}^{f} + G_{it} - P_{it}^{nu}NU_{it}, WT_{it}, CHT_{it}, NU_{it}, H_{it}, T - CHT_{it} - HR_{it}; CM_{it}, X_{it}^{m}, X_{it}^{c}, \mu_i, \varepsilon_{it}\right)$$
$$+ \beta\left[\sum_{h'} P\left(H_{t+1} = h'\right) V^{h'}\left(\Omega_{it+1}\right)\right]$$

When the child turns 18 years old, we then have the terminal value function:

$$V_{wt,cht}(\Omega_{it},\mu_i,\varepsilon_{it})$$
$$= \mathrm{E}\max_{nu\in NU} U\left(Y_{iT} + Y_{iT}^{f} + G_{iT} - P_{iT}^{nu}NU_{iT}, WT_{iT}, CHT_{iT}, NU_{iT}, H_{iT}, T - CHT_{iT} - HR_{iT}; CM_{iT}, X_{iT}^{m}, X_{iT}^{c}, \mu_i, \varepsilon_{iT}\right)$$
$$+ \beta\left[\sum_{h'} P\left(H_{T+1} = h'\right) W^{h'}\left(\Omega_{iT+1}\right)\right]$$

Therefore, based on the decision making process, the maximal expected lifetime utility is given by:

$$V\left(\Omega_{it}\right) = \mathrm{E}_{t-1}\left[\max_{\{wt,cht\}\in\Gamma} V_{wt,cht}\left(\Omega_{it},\varepsilon_{it}\right), \forall t\right]$$

CHAPTER 4 EMPIRICAL IMPLEMENTATION

The empirical specifications are motivated by the assumed evolution of the dynamic process over time and value function in the theoretical model. Existing studies regarding the impacts of maternal labor supply and childcare decisions on child nutrition and health outcome in the context of the developing countries have used single equation approach (Morrill, 1008; Poel et. al., 2008; Guo et. al., 1999). Since child's health status and mother work types are endogenously related, a single equation approach can't distinguish between an improved health outcome due to a better overall child health that are more favorable for the health production and an improved health outcome due to more income with adequate care when mother works extra hours (in the nonagricultural sector) or in the city.

We notice that there are unobserved heterogeneities that are linked with various maternal behaviors and child health outcomes. If there exists unobserved heterogeneities that influence child health outcomes that are also correlated with various maternal decisions, using common single-equation estimation techniques will result in biased estimates. For example, if the child is predisposed the poor health, her mother is less likely to work; this is going to result in an underestimation. Alternatively, if the mother has depression, she is more likely to receive help from other family members and more likely to have a child with unhealthy conditions, this is going to result in an overestimation of childcare on child health production. The simultaneous equation approach takes care of the selection bias and is more robust to distributional assumptions about the errors (both time invariant and time variant heterogeneity). The discrete factor model used in this estimation is particularly advantageous in this regard because its

semi-parametric specification takes care of the issues associated with the assumption of joint normality of the error terms within the maximum likelihood estimation technique while taking care of identification issues by using instrumental variables.

Our aim is to simultaneously estimate the equations as outlined below. Work type/location choice, maternal care time choice, child nutritional inputs choice, maternal income, child health shock and child health outcome are included in each specification as endogenous variables. These variables enter the model at the beginning of or in the middle of each period depending on the assumptions of the theoretical model. Based on the theoretical model, for example, a voluntary work type or childcare time choice made by a typical married female in rural areas is based on the comparison of benefits and costs relative to other options available. A consumer's choice in this regard is determined in the model by the information available to the decision maker including her previous decisions, current demographic characteristics and personal financial resources, child characteristics such as age, gender, education level and health state and the characteristics associated with urbanization such as availability of health care facilities, food market conditions, labor market conditions, etc. Certain outcomes such as mother's income, child health shock and health status are also modeled as a function of the decisions, the characteristics of the mother and child and community features. The empirical model follows the discrete factor random effects method, and error terms can be decomposed into time-varying unobserved heterogeneities, ν_{it}, a permanent individual component, μ_i, and an idiosyncratic component, ε_{it}. Details on how these variables are represented in the actual estimation are discussed in the data section. The system of equations jointly estimated has the following specifications with coefficients $\eta, \phi, \alpha, \beta, \delta$ and γ:

Information Set for the Empirical Model

Information Set at the Beginning of time *t*:

$\Omega_t = (H_t, WT_{t-1}, CHT_{t-1}, NU_{t-1}, S_{t-1}, Y_{t-1}, X_t, E_t^{WT}, E_t^{CHT}, E_t^{NU}, E_t^H)$

$X_t = \left(X_t^c, X_t^m\right)$ is exogenous individual characteristics (age, sex, education);

$E_t^{WT}, E_t^{CHT}, E_t^{NU}, E_t^H$: represent exogenous shifters that affect labor supply and childcare decisions (e.g., urbanization indices, local healthcare condition such as availability of health care facilities nearby, childcare amenities, family structures such as whether the child is only-child and whether grandparent is around), exogenous shifters that influence child nutritional input decision (e.g., food prices for eggs, meat, and vegetables) and health production (e.g. quality and quantity of local health care). The variables for community attributes in our theoretical framework are all decomposed into these exogenous policy-related exogenous variables determined outside of our model by policy makers. Details on how these variables determined are discussed in the Data section. Therefore**,** similarly, the information set at the beginning of time *t*+1 is:

$\Omega_{t+1} = (H_{t+1}, WT_t, CHT_t, NU_t, S_t, Y_t, , X_{t+1}, E_{t+1}^{WT}, E_{t+1}^{CHT}, E_{t+1}^{NU}, E_{t+1}^H)$

Upon entering the year *t*, the rural mother (and researcher) observes Ω_t, and her expected indirect utility function associated with a particular set of choices at time *t* ($WT_t = wt; CHT_t = c$) can be defined as

$V_{wtc}^{WC} = v(\Omega_t; WT_t = wt, CHT_t = c) + u_{wtc}^{WC}$

There might be correlation among the disturbance terms (u_{wtc}^{WC}) in the alternative-specific indirect utility functions. Such correlation may exist because our alternatives are defined by work types, childcare time and nutritional inputs. For example, if there are some unobserved tastes for work types, then these will be present for all alternatives involving work types. The correlation may also exists if there are unobserved variables that affect discrete choice outcome, also affect the demand for any other choice variables. For example, a mother who places high value on the childcare and child health

is more likely to choose high inputs of nutrition for her child. In order to account for the possible error correlations in a tractable way, we impose a commonly used one-factor structure on the equation disturbance terms.

In order to apply the discrete factor method, in this case, u_{wtc}^{WC} is defined as the unobserved individual heterogeneity that influences the mother's decisions, and this error term is decomposed as: $u_{wtc}^{WC} = \rho_{wc}^{WC}\mu + \omega_{wc}^{WC}\nu_t + \varepsilon_{wtc}^{WC}$

where $\rho_{wc}^{WC}, \omega_{wc}^{WC}$ are alternative specific factor loadings acting as the parameters that can be estimated, and μ, ν_t are permanent and time-variant unobserved individual heterogeneities that influence initial, current, subsequent conditions. In our case, unobserved permanent heterogeneity may include mother's ability or child inherent health that does not vary over time. Time-variant heterogeneity may involve life styles, child emotional or physical well-beings that change over time. ε_{wtc}^{WC} is defined as additive idiosyncratic error terms with extreme value distribution, therefore, these idiosyncratic error terms are i.i.d. distributed.

The extreme value distribution has a variance that implicitly set the scales of utilities. McFadden (1974) demonstrates that the probability that an individual makes a specific choice among the alternatives has a straightforward, analytical solution. An individual chooses a set of *wt* and *c* to maximize the indirect utility function. The probability that a certain individual will choose alternative *wt* or *c* is equal to the probability of that alternative-specific utility's being the largest of all the alternative or possible utilities. After the value function is approximated linearly with a series of expansions of its arguments (set of state variables defined as predetermined and other exogenous variables in our model), the likelihoods of the various choices' being made are revealed, depending on the distribution of the stochastic error terms.

Specifications of Maternal Choices and Child Outcomes

The probability of a specific choice *wt* and *c* over the reference alternative:

$$\ln\left[\frac{\Pr(WT_t = wt)}{\Pr(WT_t = 0)}\right] = \eta_{0w} + \eta_{1w}H_t + \eta_{2w}WT_{t-1} + \eta_{3w}CHT_{t-1} + \eta_{4w}S_{t-1} + \eta_{5w}X_t + \eta_{6w}E_t^{WT} + \eta_{7w}E_t^{CHT} + \eta_{8w}E_t^{NU} + \eta_{9w}E_t^{H} + \eta_{10w}t + \rho_w^{WC}\mu + \omega_w^{WC}\nu_t \quad (8)$$

Where *wt* = 1, 2, 3 or 4

The last period's work type choice, WT_{t-1}, childcare time choice CHT_{t-1} and time trend, *t*, allow the last period's maternal work effect (through the work experience), childcare effect (through the cost of job search/switch) and time effect to be examined. An agricultural work is captured in vector, WT_{t-1}, which allows us to test if it is easier (or more likely) to switch from nonwage work to other types of work than to switch from other types of work to nonwage work. This specification form incorporates the idea that we presented in the theory that, at the beginning of time *t*, the woman makes decisions based on all the information she observes.

In our theoretical framework, a rural woman chooses childcare time jointly with her job choices with the same amount of information she has in hand. Once a work type decision is made, a woman will know what her average working hour is like and stimulatingly make a childcare time choice. Based on this information, a multinomial logistic model can be presented as:

$$\ln\left[\frac{\Pr(CHT_t = c)}{\Pr(CHT_t = 0)}\right] = \eta_{0c} + \eta_{1c}H_t + \eta_{2c}WT_{t-1} + \eta_{3c}CHT_{t-1} + \eta_{4c}S_{t-1} + \eta_{5c}X_t + \eta_{6c}E_t^{WT} + \eta_{7c}E_t^{CHT} + \eta_{8c}E_t^{NU} + \eta_{9c}E_t^{H} + \eta_{10c}t + \rho_c^{WC}\mu + \omega_c^{WC}\nu_t \quad (9)$$

where *c* = 1, 2 or 3[16].

Log income:

[16] In our data, we observe some respondents with migratory work who provide sufficient child care because the city where they work is very close to the village where they live and a good transportation system is available.

$$\ln Y_t = \alpha_0 + \alpha_1 H_t + \alpha_2 X_t + \alpha_3 WT_t + \alpha_4 E_t^{WT} + \rho^Y \mu + \omega^Y \nu_t \tag{10}$$

In our theory, lagged child health status and child exogenous characteristics are assumed to affect mother's work efficiency and therefore have an impact on current maternal income. Y_t here incorporates both earned and unearned income so that when the mother stays at home she may still get certain amount of income base on the her characteristics and community attributes that are included in the exclusion restriction, and WT_t can be a shifter for these two types of income.

The probability of health shock[17]:

$$\ln\left[\frac{\Pr(S_t = 1)}{\Pr(S_t = 0)}\right] = \phi_0 + \phi_1 H_t + \phi_2 CHT_t + \phi_3 NU_{t-1} + \phi_4 X_t + \phi_5 E_t^H + \rho^S \mu + \omega^S \nu_t \tag{11}$$

In this specification, other than exogenous demographic characteristics and health shifters, Lagged child health, amount of care time received from mother and previous nutritional input affect the risk of experiencing the health shock in the current period.[18]

Child nutritional intake[19]:

Expected future utility for each nutritional input alternative is as follows, given the realized work type, childcare time choice, maternal income and child health shock:

$$V_{nut}^{NU} = v(H_t, NU_t, X_t, E_t^{NU}, E_t^H; NU_t = nu | WT_t, CHT_t, S_t, Y_t)$$

[17] Health Shock is a shock that has negative impacts on the overall health (usually chronic conditions). However, since chronic conditions among teenagers are very rare, we look at three types of questions as health shocks: 1. A general question asking, "Did the child get sick within the last four weeks?" 2. A detailed question asking, "Did the child get any non-communicable disease within last four weeks?" 3. A question asking for physical exam information and indicating whether the individual has low or high blood pressure. Health shock is equal to one if answer to any one of these three questions is, yes and otherwise it is equal to zero.

[18] In our empirical model, we also assume that a child's heterogeneities are correlated with his or her mother's time-invariant or time-variant unobserved heterogeneities, such as genes and habits. The factor loading here can represent such a correlation.

[19] It is difficult to observe health expenditures in Chinese household. If it is not a matter of life or death, most people choose not to go to hospitals because of high medical expenses, travel barriers, lack of medical insurance, and a poor social security system, especially in rural parts of China. This fact is also reflected in the CHNS survey data. Most people's response to a health shock will be a change in nutritional inputs. Another way to think about the health shock is to use the blood pressure and heart rate index to reflect whether a child has low/high blood pressure due to malnutrition/faculty nutrition.

The value function is written in this form because E_t^{WT} and E_t^{CHT} do not enter this value function. They do no independently affect nutritional input choices conditional on work type and childcare choice. At this stage, WT_t , CHT_t , S_t and Y_t are all realized.

The probability of nutrition consumption is defined as follows:

$$\ln\left[\frac{\Pr(NU_t = nu)}{\Pr(NU_t = 0)}\right] = \beta_0^{nu} + \beta_1^{nu} H_t + \beta_2^{nu} S_t + \beta_3^{nu} CHT_t + \beta_4^{nu} Y_t + \beta_5^{nu} X_t + \beta_6^{nu} t + \rho_{nu}^{NU} \mu + \omega_{nu}^{NU} \nu_t \tag{12}$$

In the later empirical estimation, we use continuous values of age and community adjusted nutritional Z score in order to get an idea of the relative level of nutritional input for each child[20]. For the purpose of identification, we make two assumptions here: 1. there is no omitted medical inputs and we assume, in China, people's health is mainly determined by nonmedical nutritional input; 2. medical inputs and nutritional inputs are not complementary goods, therefore, there are no cross price effects. For the purpose of identification, E_t^{NU} is not included in the specification as we assume that the nutritional intake is conditional on it.

The probability of a specific health state[21]:

$$\begin{aligned}\ln\left[\frac{\Pr(H_{t+1} = h)}{\Pr(H_{t+1} = 0)}\right] = {} & \gamma_{0h} + \gamma_{1h} H_t + \gamma_{2h} H_t \cdot NU_t + \gamma_{3h} NU_t + \gamma_{4h} NU_t \cdot S_t + \gamma_{5h} S_t + \gamma_{6h} CHT_t \\ & + \gamma_{7h} Y_t + \gamma_{8h} X_t + \gamma_{9h} E_t^H + \gamma_{10h} E_t^{NU} + \gamma_{11h} t + \gamma_{12h} t \cdot CHT_t + \rho_h^H \mu + \omega_h^H \nu_t \end{aligned} \tag{13}$$

where *h* varies from fair/poor to excellent. However, because we mainly focus on children 18 years old or younger, based on the WHO's standards, we also consider child

[20] This Z score is controlled for age and community. In the actual estimation I employ both continuous and discrete measures of child nutritional inputs based the Z score. The discrete measure of nutritional input is adopted for the purpose of robustness check; I let the thresholds be 15 and 85 percentile of the Z score to define low, medium and high nutritional inputs.

[21] I assume two types of health shock: a general acute health shock (which is defined in table 2 and a low heart rate (measured by the systolic and diastolic pressure). Therefore, I assume the effect of shocks on overall health outcomes also depends on a child's previous overall health outcomes, child's previous nutritional consumption and parental health investment. I also employ both continuous and discrete measures of health outcomes. In the actual estimation, I use continuous HAZ and discrete self-reported health, and other measures such as WAZ and BMI-for-age are also attempted.

health/growth status as being measured by height-for-age Z score, which is a continuous measure of child health. The specification of continuous dependent variable in (13) is likewise. For this specification, we also include various interaction terms. For example, the interaction between time and childcare time to reflect the fact that the effect of childcare time on child health production may change over time.

Initial Conditions

We cannot "model" initial conditions because we do not observe these individuals' behaviors, choices, and conditions before our initial period. Therefore, these initial equations cannot be the same as specifications for subsequent periods, and we may only use reduced-form specifications to infer these initial conditions. However, for the purpose of joint estimation, these equations should also include appropriate variables for identification (e.g., the parameters of an equation can be identified if it is known that a variable does *not* enter into the equation, while it does enter the other equation) and also unobserved permanent individual heterogeneities that affect the modeled behavior.

Each individual in our sample is followed at least for two periods; therefore, the "initial" condition should include individual observations in the first wave. The initial time period in our sample is 1997. One of the reasons why we choose 1997 as our initial period is that the survey questions that we use changed considerably starting from 1997, and many variables in 1993 survey changed or disappeared in 1997 survey. We introduce child birth weight, BW_0, to indicate a child's initial health[22], exogenous variables that influence choices, E_0, as the initial conditions. In our survey, the data are collected at the end of each period by asking about the retrospective questions. Therefore, the health condition collected at each period t must represent the health condition that enters period $t+1$. Because of the individual permanent heterogeneity within each specification, initial

[22] Since we were not able to get the birth weight information for all the respondents in our sample, we also use the self-reported health status in the 1993 wave.

equations can be jointly estimated with subsequent dynamic equations.

More detailed specifications are as follows[23]:

a. Probability of initial job choices:

$$\ln\left[\frac{\Pr(WT_0 = wt)}{\Pr(WT_0 = 0)}\right] = \tau^1_{0w} + \tau^1_{1w} BW_0 + \tau^1_{2w} X_0 + \tau^1_{3w} E_0^{WT} + \tau^1_{4w} E_0^{CHT} + \tau^1_{5w} E_0^{NU} + \tau^1_{6w} E_0^{H} + \rho^1_w \mu \tag{14}$$

b. Probability of initial childcare time choices:

$$\ln\left[\frac{\Pr(CHT_0 = c)}{\Pr(CHT_0 = 0)}\right] = \tau^2_{0c} + \tau^2_{1c} BW_0 + \tau^2_{2c} X_0 + \tau^2_{3c} E_0^{WT} + \tau^2_{4c} E_0^{CHT} + \tau^2_{5c} E_0^{NU} + \tau^2_{6c} E_0^{H} + \rho^2_c \mu \tag{15}$$

c. Probability of initial health shock

$$\ln\left[\frac{\Pr(S_0 = 1)}{\Pr(S_0 = 0)}\right] = \tau^3_{0s} + \tau^3_{1s} BW_0 + \tau^3_{2s} X_0 + \tau^3_{3s} E_0^{H} + \tau^3_{4s} CHT_0 + \rho^3 \mu \tag{16}$$

d. Probability of initial income

$$\ln Y_0 = \tau^4_{0y} + \tau^4_{1y} BW_0 + \tau^4_{2y} X_0 + \tau^4_{3y} WT_0 + \tau^4_{4y} E_{it}^{WT} + \rho^4 \mu \tag{17}$$

e. the probability of discrete nutritional input Z score level here:

$$\ln\left[\frac{\Pr(NU_0 = nu)}{\Pr(NU_0 = 0)}\right] = \tau^5_{0nu} + \tau^5_{1nu} BW_0 + \tau^5_{2nu} S_0 + \tau^5_{3nu} CHT_0 + \tau^5_{4nu} Y_0 + \tau^5_{5nu} X_0 + \rho^5_{nu} \mu \tag{18}$$

f. Probability of different health levels[24]:

$$\begin{aligned}\ln\left[\frac{\Pr(H_1 = h)}{\Pr(H_1 = 0)}\right] = {} & \tau^6_{0h} + \tau^6_{1h} BW_0 + \tau^6_{2h} CHT_0 + \tau^6_{3h} S_0 + \tau^6_{4h} NU_0 + \tau^6_{5h} Y_0 + \tau^6_{6h} X_0 \\ & + \tau^6_{7h} E_0^{H} + \tau^6_{8h} E_0^{NU} + \rho^6_h \mu\end{aligned} \tag{19}$$

Implication of jointly estimated equations:

From the model set-up and specifications above, it implies that, within the same time period, unobserved individual heterogeneities not only influence work type choices and time allocation choices, but also affect mothers' nutritional inputs choices. Thus,

[23] These are specifications for discrete choices or outcomes.

[24] Initial health production is correlated to subsequent health; therefore, no previous decision should be involved in the initial condition of health production.

these behaviors are interlinked. In addition, these work type choices and time allocation choices are connected with nutritional consumptions through maternal income and child health shock. Across time, current nutrition consumption and childcare time affects health condition at the end of the time period (or health condition entering the next time period), which affects nutrition consumption and childcare time in the following period. Therefore, current nutrition consumption and childcare time also affects the next period's maternal decisions and child outcomes.

Identifications of the System of Dynamic Equations

For the identification purpose, given the unobserved heterogeneity, some of our explanatory variables should be exogenous. Therefore, a given value is required for each of our variables $E_t^{WT}, E_t^{CHT}, E_t^{NU}, E_t^{H}$ and X_t. This given value is determined outside of our model. Also, given the unobserved heterogeneity, some of our lagged variables should be exogenous, which requires given lagged values for some of the endogenous variables. These given values are determined in the last period. For the initial condition, we have included additional exogenous variables that influence initial condition equations independently, such as[25] BW_0, E_0 and X_0. We also deal with the endogeneity issues of explanatory variables and specify individual unobserved heterogeneities, such as tastes and life style. In addition, lagged i.i.d. errors affect current behaviors through the lagged child health outcome in the work type, childcare time and nutritional input equations. Finally, identification is also improved by nonlinearity structure of the specification (Bhargava, 1983; Arellano and Bond, 1991).

Maximum Likelihood function[26]*:*

Our estimation strategy is to use a discrete factor model that controls for the

[25] We specify X as the mother and child's demographic features. We put superscript *m* and *c* on X in the theoretical framework to indicate corresponding demographic characteristics

[26] Here, we represent only the likelihood function for discrete choices and outcomes. For continuous choices and outcomes, we replace the discrete probability with the probability density function.

simultaneous relationship among the equations by approximating the effects that are common but unobservable across equations. The permanent heterogeneity, μ, captures the dependence across equations at each point of time and the dependence across different time periods and equations (including initial equations and attritions). This approach controls for the endogeneity of work type, childcare time and nutritional input choice in the outcome equations. A random effects specification was used to apply the model to a panel of four years of data. A discrete distribution is assumed for the correlated components, μ and ν_t. The discrete factor model uses a variable number of discrete parameters (mass points) to approximate this cumulative distribution. The distribution of the μ and ν_t was initially approximated using three and two mass points respectively (M = 3, L = 2). The values of the first mass points were normalized to zero. The benefit of the discrete factor random effects model is that no assumption is imposed on the individual heterogeneity. Therefore, we may increase the value of support for M and L to obtain the best fit, based on the log likelihood values. Further, we assume that θ_m is the probability weight for permanent unobserved individual heterogeneity, and ψ_l is the probability weight for time varying unobserved individual heterogeneity. The discrete factor model estimates parameters through generating mass points and associated probability weights, from which the mass point values (other than the first points) and the probability weights values associated with each mass point are calculated. The advantage of the discrete factor random effects model is that it relaxes the parametric assumptions[27]of the traditional instrumental variables approach in the context of simultaneous equations estimation (Goldman, 1995).

Based on our specifications and estimations techniques, we may write down the following likelihood function. The indicator functions involved in the likelihood function

[27] The instrument must be correlated with the endogenous explanatory variables, conditional on the other covariates. The instrument cannot be correlated with the error term in the explanatory equation, that is, the instrument cannot suffer from the same problem as the original predicting variable.

reveal choices and states. If there is a choice, there is a probability associated with the choice; if there is no such choice, there is no such probability.

Initial condition for the nth person (t=0):

$$\sum_{m=1}^{M}\theta_m \cdot \Pr\left(S_0=1\middle|\mu_m\right)^{1(S_{n0}=1)}\cdot\left(1-\Pr\left(S_0=1\middle|\mu_m\right)\right)^{1(S_{n0}=0)}$$
$$\cdot\prod_{wt=0}^{4}\Pr\left(WT_0=wt\middle|\mu_m\right)^{1(WT_{n0}=wt)}\cdot\prod_{c=0}^{3}\Pr\left(CHT_0=c\middle|\mu_m\right)^{1(CHT_{n0}=c)}$$
$$\cdot\prod_{nu=0}^{2}\Pr\left(NU_0=nu\middle|\mu_m\right)^{1(NU_{n0}=nu)}\cdot\left(f\left(Y_0\middle|\mu_m\right)\right)\cdot\prod_{h=0}^{2}\Pr\left(H_1=h\middle|\mu_m\right)^{1(H_{n1}=h)}$$

t>1 for the nth person:

$$\sum_{l=1}^{L}\psi_l \cdot \Pr\left(S_t=1\middle|\mu_m,\upsilon_{lt}\right)^{1(S_{nt}=1)}\cdot\left(1-\Pr\left(S_t=1\middle|\mu_m,\upsilon_{lt}\right)\right)^{1(S_{nt}=0)}$$
$$\cdot\prod_{wt=0}^{4}\Pr\left(W_t=wt\middle|\mu_m,\upsilon_{lt}\right)^{1(WT_{nt}=wt)}\cdot\prod_{c=0}^{3}\Pr\left(CHT_t=c\middle|\mu_m,\upsilon_{lt}\right)^{1(CHT_{nt}=c)}$$
$$\cdot\prod_{nu=0}^{2}\Pr\left(NU_t=nu\middle|\mu_m,\upsilon_{lt}\right)^{1(NU_{nt}=nu)}\cdot\left(f\left(Y_t\middle|\mu_m,\upsilon_{lt}\right)\right)\cdot\prod_{h=0}^{2}\Pr\left(H_{t+1}=h\middle|\mu_m,\upsilon_{lt}\right)^{1(H_{nt+1}=h)}$$

Combining them together:

$$L(\Theta)=\prod_{n=1}^{N}\left\{\sum_{m=1}^{M}\theta_m \cdot \Pr\left(S_0=1\middle|\mu_m\right)^{1(S_{n0}=1)}\cdot\left(1-\Pr\left(S_0=1\middle|\mu_m\right)\right)^{1(S_{n0}=0)}\cdot\prod_{wt=0}^{4}\Pr\left(WT_0=wt\middle|\mu_m\right)^{1(WT_{n0}=wt)}\right.$$
$$\cdot\prod_{c=0}^{3}\Pr\left(CHT_0=c\middle|\mu_m\right)^{1(CHT_{n0}=c)}\cdot\prod_{nu=0}^{2}\Pr\left(NU_0=nu\middle|\mu_m\right)^{1(NU_{n1}=nu)}\cdot\left(f\left(Y_0\middle|\mu_m\right)\right)\cdot\prod_{h=0}^{2}\Pr\left(H_1=h\middle|\mu_m\right)^{1(H_{n1}=h)}$$
$$\prod_{t=1}^{T_n}\left[\sum_{l=1}^{L}\psi_l \cdot \Pr\left(S_t=1\middle|\mu_m,\upsilon_{lt}\right)^{1(S_{nt}=1)}\cdot\left(1-\Pr\left(S_t=1\middle|\mu_m,\upsilon_{lt}\right)\right)^{1(S_{nt}=0)}\cdot\prod_{wt=0}^{4}\Pr\left(W_t=wt\middle|\mu_m,\upsilon_{lt}\right)^{1(WT_{nt}=wt)}\right.$$
$$\cdot\prod_{c=0}^{3}\Pr\left(CHT_t=c\middle|\mu_m,\upsilon_{lt}\right)^{1(CHT_{nt}=c)}\cdot\prod_{nu=0}^{2}\Pr\left(NU_t=nu\middle|\mu_m,\upsilon_{lt}\right)^{1(NU_{nt}=nu)}\cdot\left(f\left(Y_t\middle|\mu_m,\upsilon_{lt}\right)\right)$$
$$\left.\left.\cdot\prod_{h=0}^{2}\Pr\left(H_{t+1}=h\middle|\mu_m,\upsilon_{lt}\right)^{1(H_{nt+1}=h)}\right]\right\}$$

CHAPTER 5 DATA

Child Health Nutritional Survey (CHNS)

The data is from the China Health and Nutrition Survey (CHNS), conducted among nine representative provinces by the Carolina Population Center and the National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention. The survey was designed to examine the effects of the health, nutrition, family planning, and labor market policies and programs implemented by national and local governments. The survey has been conducted eight times, from 1989 to 2009. The survey uses a multistage, random cluster process to draw a sample of about 4,400 households with a total of 19,000 individuals in nine provinces that vary substantially in terms of their geographic location, economic development, public resources, and health indicators. For the purpose of this study, CHNS adult survey provides rich information about parents, maternal occupations, time allocation, childcare expenditures, education, parental wages, work time, and sources of childcare before 2006. The surveys contain detailed information on the health outcomes of adults and children younger than eighteen, including their BMI, HAZ, sickness, and children's food and nutritional intake. The community survey collects information from a respondent knowledgeable on community infrastructure, including the availability of water, transportation, and electricity; services like the number of health facilities and retail outlets in the neighborhood; population density; and job market characteristics, such as prevailing wages, employment rate, and related variables.

Thus, this survey provides enough information to show how maternal decisions regarding work type and location, maternal care time, and investments in children's health

can affect the rural children's health conditions using a variety of measures. Our sub-sample (four waves of the survey from 1997 to 2006)[28] consists of rural and suburban families with information about parent's labor force participation, children's characteristics, and other related information for children aged three to eighteen. In our study, we have tracked children from three to eighteen years of age because employment and time allocation behaviors of mothers with younger children are quite different due to the decisions about fertility and infant care. In China, after a child turns three, she can go to daycare or schools called "pre-kindergarten," and the physical attachment between the mother and her child is not as tight as it is before the child turns three. Therefore, the mother's employment choice is not highly constrained by the physical bond she usually has with her child right after birth, such as the need for breast-feeding or cuddling before the child is able to walk. What is more, we do not observe significantly different HAZs across populations for children under age three. The upper bound for child's age is 18; age eighteen is the threshold age at which most children stop growing. At this age, most of the children finishes the government mandated education level and either go for higher education of accept a job. Therefore, the age group we have chosen is appropriate for using HAZ to infer a child's growth or health condition.

In 1997, some survey questions were introduced that adopted different methodologies in order to improve accuracy. A self-reported health question was employed to let people indicate their current health at the time of the survey instead of their average health over the year. This improvement was helpful for our purpose. After 1997, the Chinese government set up a new 5-year project and started rural labor market reform to increase city expansion and job opportunities, along with intensive nonagricultural job training and subsidies for jobs in rural areas. Therefore, our choice of

[28] One explanation for the small time gap between 2004 and 2006 is that national and local government policies regarding job training and job market were put in place after 2003 to induce faster job changes.

the time period allows us to examine the effect of certain policies on both maternal labor participation and on children's health. We have not included the year 2009 because certain questions that we use for our variables were either merged with others for that year or were deleted. The longitudinal structure of CHNS ensures that the respondents are followed for several years, and new households are brought into the sample to maintain cross-sectional composition. We restricted our sample to those who are married[29] and have at least one child. To fit respondents with more than one child into our model, we focus on the health of the youngest male child. Not every respondent is observed four times since the sample size decreases over the four waves of survey due to attrition, change of residence, or the child's turning eighteen. However, each pair of mother-and-child couple in our sample is followed for at least two years so that the dynamic estimation can be performed or dynamics over the time path are included. A detailed description of the families in the sample is shown in table 1. Summary statistics for the endogenous and exogenous variables across time are provided in tables 2 and 3. Table 3 describes the exogenous factors that affect maternal employment, childcare behaviors, health investment, and children's overall health outcomes, including demographic features of mothers and children, community characteristics and representative CPI-adjusted food prices. The variables explained in this section correspond to those in the empirical section.

Description of Endogenous Variables

We use the objective Height-for-Age Z score (HAZ) as the measure of a child's overall health outcome. HAZ was introduced by the World Health Organization (WHO) as a measure for a child's growth/health status. This measure (which was developed using data collected in the WHO Multicenter Growth Reference Study) shows a child's height

[29] We do not observe divorce in our sample, as the divorce rate is quite low in rural China.

as a number of standard deviation above or below the average height for the child's age and sex. We have also used self-reported health status in our test after simulation. Since CHNS also provides access to food and nutrition consumption information, we have employed the child nutritional input Z score as well. We use each province's average nutrition consumption over the whole sample as the reference inputs; thus the Z score allows us to observe the relative nutrition/health investment in each child across different provinces and ages. The nutrition consumption is defined as the average consumption over the last month after the respondent observes price change and child health shocks. It satisfies the time path of our model. The nutrition files were constructed by the Carolina Population Center, and the macronutrient/energy is examined. We also use the total consumption of commonly eaten food (rice, pork, vegetables, egg and milk) for the robustness check.

In CHNS, respondents report acute illness (such as symptoms of fever, cold, and flu) in the last four weeks. This is used as a general health shock. Although child malnutrition is sometimes not observable, this survey also provides information about the physical examination, making physical conditions like blood pressure and heart rate accessible. Based on the American Heart Association's standard for systolic and diastolic pressure, about 30 percent of children in our sample can be defined as having low blood pressure caused by not having sufficient nutrition (The most common cause of low blood pressure is faulty nutrition or malnutrition). Faulty nutrition can result from lack of quality and quantity of childcare, and malnutrition can result from a diet deficient in calories, protein, and vitamins.

We categorize CHNS's detailed information on respondents' occupations and work intensity into four groups according to the level of their childcare compatibility. Since the subsample we use represents the respondents who live in rural areas, the

mothers' average education is only about six years, which indicates that they are likely to engage in low-income and low-skilled jobs. As table 2 shows, the majority of individuals in our sample work in the agricultural sector. However, the proportion of nonwage workers decreases over the years mainly because of the Chinese government's rural labor market reform and city expansion projects. If a mother spends less than an hour in childcare, her childcare time is defined as extremely low. Medium childcare time is from three to five hours. Over five hours in childcare reflects a high level of maternal care. Table 2 indicates that the percentage of women who spend a low amount of time in childcare increases over the years. At the same time, we also observe that the inflation-adjusted maternal income (using 2009 as the base) increases over time. For this variable, we include both wage and self-employment income. In general, maternal income is lower than father's labor income, but as the labor market changes and many women in China became main income earners, this gap may become smaller over time.

Factors Affecting Maternal Work and Childcare Choices

Exogenous factors affecting choice of work type can be categorized into a group of variables reflecting the levels of urbanization. CHNS's survey takes place from the North to the South of China, including some relatively developed provinces such as *Jiangsu* and some under-developed provinces such as *Guizhou*. Urbanization indices include the number of households or population size in the neighborhood/village which can trigger government's nonagricultural projects. Also, the CHNS community file provides the average daily wage of female workers in the community, which plays an important role in determining females' willingness to work in the wage sector in that village. Proportion of workers in agriculture or in the industrial sector, or in the work outside the village also influences a mothers' decision regarding whether and where to work. The location of a village - whether it is close to an open trade area or city

(reflecting city expansions) - and the availability of convenient transportation services also affect an individual's work place decision. Forced relocation, resulting from the government's urbanization policy, also results in more non-agricultural work and affects mother's decision.[30] This has been captured by the living arrangement questions in the survey. In the initial correlation analysis, we also use external FDI (Foreign Direct Investments) and number of project in cities within a province[31] as instruments for the wage differential. In theory, we assume that individuals allocate their nonworking time as efficiently as possible to maximize their utility. Childcare time is a part of the nonworking time, and this time is affected by the neighborhood amenities such as recreation facilities and free markets around the households. These amenities will impact the mothers' nonworking activities and allocation of time (including the time spent in childcare). For example, if there are parks or markets nearby, a typical Chinese will likely spend more time with her child such as playing and cooking food for her child. Availability of tap water and electricity is also important in predicting individuals' activities in rural China. Without tap water, a mother has to spend time fetching well water, which also influences her nonworking activities such as household chores and childcare.

Factors Affecting Nutritional Input

Parents in developing countries like China regard food consumption as a primary way of improving child health condition. As a result, food price is one of the most important factors in the amount of nutrition provided to children. We use the CPI-adjusted

[30] The relocation here is not referred to voluntary relocation from village to city. The Government needs to use farmland to build enterprises and highways following its urbanization policy. In Communist China, land is owned by the government, therefore, if it needs the land for the purpose of industrial development, it will take away farmers' lands and relocate them to cities by offering them an apartment to stay, and consequently, some farmers are forced to transfer from agricultural work to nonagricultural work.

[31] Treatment effects of migratory work have been tested by propensity score matching. I imported data from China Yearbook, given the fact that main forces driving rural women into cities are wage differentials that were led by Foreign Direct Investment (FDI) and number of industrial projects in cities, the treatment effects of migratory work on child health and nutritional inputs are 0.371 and 0.427, with t-statistics 4.440 and 2.426 respectively. Treatment group has 144 individuals and control group has 1255 individuals.

prices of the four mostly consumed food (for nutrition supplements) in China to infer a mother's nutritional inputs decision and health investment decision for her child. These food items are egg, meat, vegetables, and diary products. In addition, other variables such as the family structure (one child or male child indicator) and the availability of grandparent also influence the child nutritional input.

Health Shifters

Other than maternal choices, certain exogenous conditions may affect a child's overall health outcomes. In developing countries, especially in the rural areas of those countries, hygiene is a significant issue and is the main reason why most children get sick. One of the goals of healthcare reform in China is to improve the hygiene conditions. Based on the survey and model, we are able to test the hygiene effects on child health outcomes (e.g.; we man examine the effect of the source of drinking water such as tap water). We may also observe the use of medical insurance, medical insurance provision is exogenous in rural areas as it is often offered by the federal and local governments or parents' employers. In China, people in rural areas rarely purchase private insurance because they lack the information about private insurance providers and because the private insurance market is quite low in those areas.

In addition to these factors, we have also created variables that reveal the quantity and the quality of the health care provision. In our sample, the number of health facilities, the distance and minimum travel time to the closest facilities, the average waiting time checked by health workers, and the availability of needed medicines are all considered factors that influence one's health. Number of and travel time to health facilities are used to indicate the quantity of childcare, while the waiting time is used to indicate the quality of care. We use the longer waiting time as a proxy of the better quality. From table 4, however, what we observe is that both quantity and quality of rural health care provision

tend to decrease over time. This may explain why we see decreased child health outcomes over the same time period. Finally, family structure also enters the equation, as our theoretical framework considers the presence of grandparents at home as a supplement to the maternal care.

CHAPTER 6 RESULTS

Joint Estimation Results

Short run estimation results are shown in the table 5 to table 10. Equations specified in the empirical section are jointly estimated with initial conditions. Attritions are also jointly estimated with these equations to make sure that these attritions follow a random process. We first estimate the equations without the unobserved heterogeneity. Estimations with the unobserved individual heterogeneity are then performed to avoid bias and overestimation[32]. Time trend and interactions between health shock and nutritional inputs, health outcomes and nutritional inputs, gender and other exogenous variables are also included in the equations, and they are significant across all specifications in general.

Table 5 presents the multinomial logit regression results of different work types relative to no work. As we expected, the lagged maternal work type choice seems to predict the current work decision well. For example, the lagged agricultural work negatively influences the log odds of choosing nonagricultural work relative to staying at home. Thus, if we compare the coefficients on row 2 to row 5, we will conclude that, in general, previous work type choice significantly and positively affects the log odds of choosing this work type relative to other work types. If we look at the row 5, after controlling for other variables, it also seems that transition from migratory work to work types within village is statistically insignificant. Thus, once the mother previously works out of village, her current relative probabilities of working in the village is not that

[32] The probability weights on three permanent heterogeneity mass points are 0.043, 0.385 and 0.571, and the probability weights on two time-variant heterogeneity mass points are 0.739 and 0.260. The overall likelihood value is -29288.911

affected. In addition, when the mother is engaged in both types of work in the last period, the transition to non-agricultural work is more likely (0.467 versus 0.831). Another interesting phenomenon we observe is that once workers engage in migratory work, they are more likely to stay in that type of work in our sample (with 1.203 being the biggest number on row 5). Maternal education is also a significant factor affecting mother's work type choices. A more educated mother is more likely to engage in nonagricultural work or migratory work that requires more skills (0.095 versus -1.106), while the relative probability of not working increase as a woman receives insufficient education. Other than chronic or catastrophic symptoms such as hypertension and impairments, mother's acute health conditions such as health shock seem not to predict her work choice, which is in accordance with characteristics of low income workers China. These workers are willing to work under any condition unless they are severely ill or there is a job penalty related to chronic health condition. Exogenous policy-related factors with regard to urbanization also have the expected signs and they are also statistically significant. Population density in a region tends to negatively affect the likelihood of an individual working relative to not working in the area. In our case, more populated areas usually have more competition for farm lands or local jobs and increase the possibility of unemployment or working out of the villages. Number of work forces in enterprises also influences one's work choice. For example, if an individual observes more people working in big enterprises than in farm lands, she will more likely follow the trend. City expansion and urbanization indicated by more convenient transportation and shorter distance to cities will also make people more willing to choose nonagricultural work or work in cities.

Table 6 shows the estimation results of multinomial logit probability of providing different amount of childcare time relative to spending little or no time at all. As we

expected, choice of how much time to spend in childcare is determined by the child health in the last period (0.029 (low), -0.081 (moderate) and -0.247 (High)). A healthier child is less likely to get attention of her mother and therefore might receive less amount of care time. Previous childcare time and current childcare time is also linked together reflecting a consistent behavior (row 6, 7 and 8). Moreover, a well-educated mother is able to take good care of her child and spends more time taking care of her child (0.051 versus 0.063). Again, only when diagnosed to have a chronic or severe condition like hypertension and impairment, the mother's health is significant in predicting the amount of care time, which reflects the fact that, in Chinese culture, it is a mother's responsibility to work hard and take good care of her children regardless of minor conditions. Work intensity (embedded in work types), as we have predicted, also significantly influences a mother's time spending in childcare and, therefore, is another important determinant of the relative log odds of childcare time provision. For example, switching from nonagricultural work to migratory work tends to reduce the probability of moderate and high childcare time (-0.121 versus -0.198; -0.140 versus -0.212). Another crucial source of childcare provision is the grandparents; in China, families with busy workers rely heavily on grandparents to take care of their grandchildren, as we can see from the table, the effect of grandparent on childcare provision is significantly negative, which reflects the fact the mothers regard grandparent care as a substitute of maternal care, but what is the actual effect of grandparent care on child health? We will see that in the following tables. Also, Availability of recreation amenities, free markets or time saving device to take care of household chores such as in-house water tap (in rural China, people usually walk to a distant place to get water from a well) play a role in affecting an individual's childcare time provision. Again, health provision quantity and quality such as availability of local health care facilities, lower cost of medical service, longer waiting time and medical

insurance also predict maternal care in an expected direction.

Table 7 represents the logit regression results of health shock. Unsurprisingly, the probability of a child getting sick is significantly affected by the amount of care time a mother devotes into her child. Therefore, the sign of both moderate and high childcare time provision is significantly negative (-0.312 and -0.375), and the high amount of childcare time predicts lower probability of getting health shock than the moderate care time. Also, more attention and better environment is given to the child if he or she is the only one in the family, therefore, he or she is less likely to experience the health shock. After controlling for other variables, a male child is more easily to get shock probably because of the risky nature or behavior of boys. In addition, more educated children will likely avoid behaviors harmful to their health and consequently less likely to be ill. Variables associated with health care provision such as the number of health facilities measuring and the quantity of care and minimum waiting time measuring the quality of care also influence the risk of a child being sick. The better the quality and quantity of medical provision (indicated by shorter waiting time, larger number of health facilities and less travel time to these facilities), the lower is the risk of getting ill.

Table 8 shows the regression results of log of maternal income. From the table, we see that maternal income is significantly positively influenced by child's last period's health, while the effect of maternal health (except hypertension) is insignificant, reflecting the fact that, in China, a mother cares more about her child's health than her own health condition while working, and her work efficiency is consequently more affected by child health. Also, not surprisingly, work types play an important role determining a mother's income, and from their coefficients which increase with the work intensity, it seems that individuals working outside of village or taking extra loads of work usually earn more than those who engage in local agricultural or nonagricultural work. Policy-related factors

reflecting the labor market reforms and urbanization such as average wage level in a community and closeness to an open trade area also affect how much a woman can earn. City expansion and nonagricultural wage rules set up by the government have significant effects on one's earning, while isolated places where most people are engaged only in agriculture result in lower income levels.

Table 9 shows the results of child nutrition Z score regression. Variables influencing child nutrition consumptions include previous child health conditions, current health shock, maternal childcare time and demographic feathers. If a child is healthier in the last period, her mother will less likely worry about her child's nutritional input, so the impact of the lagged child health is negative. However, if this child gets sick in the current period, as we have expected, a mother will respond by providing her child with more nutrition. Also, extra load of work or work in the city will positively affect the inputs through higher income level. In addition, maternal childcare time is also a significant predictor of child nutritional input. Holding other factors constant, higher childcare time often is often accompanied by higher child nutrition consumption. Again, mother's and child's demographics features also have significant impacts on a mother's decision about her child's nutritional input.

Table 10 shows the results of child health outcome regression. In accordance with Grossman (1972)'s health production theory, we also find that a child's current health status is significantly and positively associated with her health condition in the last period. Additionally, as we expected, higher maternal income, enough childcare time and higher nutritional input are more favorable to child health without any surprise. A child's own characteristics, such as weight, gender, age and education are also important determinants of her health production. For example, a well-educated child tends to have better health condition. Further, a child's health status is also linked to her mother's individual

characteristics, for example, an older and well educated mother usually has a healthier child. Health care provision variables also directly affect the child health outcomes. Medical costs for common illness shows a negative effect, quantity of care provision indicated by the number of and distance to health facilities are significantly associated with child health with expected signs. In addition, the effect of grandparent being around taking care of grandchild seems insignificant even thought this factor influences the maternal care time spent in child. It may be due to the fact that reliance on the elderly in the family to take care of children does not always produce positive and satisfactory results as the elderly usually have poor physical and emotional conditions.

Simulation of Marginal Effects

To have a better understanding of the marginal effect of rural mother's employment choice on child health and growth over time, the coefficients (log odds ratios) that we have discussed in the previous section for each estimation equation may not be accurate. For example, in the single health production equation, the coefficients we have not be able to capture the marginal product of maternal work type on child health. Within the setting of jointly estimation, however, since we have taken care of the endogeneity bias of right-hand-side variables, we can fix maternal work and simulate what happens to child health. Also, the dynamic structure of the model indicates that mother's labor force participation decisions affect the health of the child over a period of time and all of them may be affected by some other conditions of the past and the present. These can have effects on the present and future behavior pattern of a mother through the health condition of the child in the past, health shock and other exogenous factors like food price. The change in mother's labor participation behavior also affects the demand/use of nutritional input for her child. Thus a dynamic model that includes the effects of the past conditions and behavior, unobserved time varying and time independent heterogeneity can better

explain the outcome. ,

Thus, this dynamic model helps to investigate the long run impact of maternal employment and maternal care decisions and can answer policy questions by performing simulations. We simulate child health status outcomes using self-reported health status and average HAZ index under fixed work type and childcare choice scenarios. Simulation is achieved by generating 200 replication of each individual allowing, per replication, one draw from the permanent individual heterogeneity distribution for four waves of the survey from 1997 to 2006 and draws every period from the time-varying heterogeneity distribution. Based on the initially observed characteristics, endogenous right-hand-side variables are simulated for each period and, because the endogeneity bias is controlled in the model, given the simulated choices, a child's health outcome is updated at the end of the period. This updating process is repeated for the second, third and fourth period.

In table 11, we present the simulated probability of each health outcome for the child (good and fair/poor health) and simulated average HAZ index for each maternal work type, with and without controlling for unobserved permanent and time-varying heterogeneity. We see that the simulated HAZ at the end of the fourth wave drops as the mother chooses to in work in the nonagricultural and migratory working sectors. By comparison, we notice that not working (home production) or working in the agricultural sector produces higher probability of good child health outcomes than other employment alternatives. However, if the unobserved heterogeneity is not controlled, other alternatives, especially maternal migratory work, give rise to higher chance of good child health. This may be due to the overestimation of the effect of maternal employment decisions on child health when unobserved factors are ignored.

In order to illustrate how an employment transition from one sector to another influences the percentage of child with different health outcomes, we list differences in

predicted health status across alternative maternal employment scenarios in table 13. It is observed that the probability of good health status increases when we shift from any nonagricultural sectors to no work (or self-employed at home) with the largest increase coming from switching from the migratory work (2.35), while shifting from agricultural work to no work will make the child worse off in terms of good health (-1.83). Working in city significantly reduces the possibility of good health by 4.18 compared to work solely in agricultural sector, and working in local nonagricultural sector also significantly reduces the possibility of good health by 2.69 percentage points compared to work solely in agricultural sector. Choosing to work in city also significantly increases the probability of fair/poor health (by 6.62 percentage points) compared to work in agricultural sectors locally. Also, from the table, what we may observe is that transition from agricultural to migratory work gives rise to a higher decrease in probability of good health than the transition to nonagricultural work and the trend is also the same in term of the change in HAZ. This might indicate that, in the long run, working in city is particularly harmful to those children who are left behind in village by their mothers.

Table 14 reports the percentage of individuals who are in good and fair/poor self-reported health conditions and who have average HAZ index under each alternative of maternal work type and maternal childcare scenario. Not surprisingly, as we compare numbers in each row, as the mother spend less time in childcare, the probability of her child being in good health condition decreases in the long run. Interestingly, if we hold maternal care time fixed the probability of good health decrease as the mother switches to migratory working sector. In other words, under the same childcare time provision, a mother engaged in both agricultural and nonagricultural sector have a higher chance of getting a child with good health outcome. This is likely because of the quality of childcare provision. The work intensity of migratory work is higher than that of the work in the

village, and a mother may get frustrated traveling between home and the working site. Therefore, even if the childcare time is the same, the migratory working mother may perform worse than the mother who only works in village.

Policy Simulations for Income and Substitution Effects

In the previous section of the paper, we performed the simulation of work type and maternal childcare on child health. However, questions such as how different exogenous forces will drive maternal behaviors regarding work type and childcare time remain unclear. One thing we are interested is to investigate the income effect and substitution effect of different forces on mother's choices and child health outcome. In our simulations, we test the pure income effect, substitution effect and total effect through the channel of subsidies to certain food price, medical care cost and wage increase. In the process of simulating the income effects, with regard to the food price, we choose the price of milk in rural areas as most village farmers are regarded as consumers instead of producers of milk[33]. Also, regarding the medical cost, we include the most common medical cost that a typical rural household has to bear.[34] In addition, an increase of female wage rate (or the opportunity cost of taking care of a child) is simulated for testing both substitution effect and income effect. Slutsky decomposition is used to isolate the income and substitution effects caused by a rise in wage.

Based on the model estimates, given initially observed exogenous right hand side variables, we perform both long run and short run simulations. In the process, we

[33] Firstly, in the sample, I do not observe subjects owing milk farm. Secondly, in China, government regulates the production of milk, as an individual, one might work as a worker in state-owned or monopolistic milk company/factories such as YiLi. However, if one sells the household produced milk in the market, she will be penalized. In certain provinces, such as Inner Mongolia there might exist tribes raising cow for own consumption, but these provinces are not included in CHNS. Also, from CHNS nutritional survey, we do observe people consume milk regularly. Therefore milk price subsidy is simulated.

[34] Medical cost in my sample is captured by the average prices of first level defense medicine in CHNS in regard to acute symptoms such cold, flu, cough, fever, diarrhea, etc. Because of lack of good health systems, insurance or facilities in rural areas of china, purchasing these types of medicine for self-treatment or precautionary reason becomes very important to rural households.

generate 200 replications of each individual allowing, per replication, random draws from the permanent and time-varying unobserved heterogeneity distribution from the estimated model. Key findings are as follows:

In Table 14, simulation of pure income effect is achieved by giving subsidies to certain food price, which in our simulation is per liter milk price. Subsidies are also given to medical costs of common acute symptoms. We firstly fix the price level of food and medicines, and then simulate a drop of 5 Yuan each time. By subsidizing the milk price, what we found is: as a mother receives more subsidies to milk price and medical cost, her child's health status will be better off. In other words, the child becomes healthier as maternal real income increases and the income effect is positive. With regard to the maternal work type, however, the income effect is mixed. From the table, what we observe is that when people get more subsidies (more real income), they are more likely to work in the less labor-intensive sector such as the agricultural working sector, and the probability of choosing a nonagricultural or migratory type of work decreases as the rural woman becomes wealthier. That is to say, maternal nonagricultural or migratory work is an inferior good. Or if we treat work type as one categorical or ordinal variable the value of which increases from agricultural to migratory work, this work type is an inferior good. On the other hand, a mother tends to spend more time with her child after receiving subsidies (the increase of real income). So, in context of rural China, childcare time is a normal good. In addition, simulating a wage change also yields similar conclusions. According to the Slutsky decomposition and table result, if we isolate the income effect from the total effect of a wage change, which is equivalent to a drop of real income, what we may find is a trend of mother spending less time in childcare and switching to more labor intensive nonagricultural sectors. From the simulations, what we may conclude is that certain subsidies may be a way to compensate the negative effect brought by the

urbanization and let the rural mothers be more engaged in the agricultural work.

In table 15, we also simulate a bump of rural female wage to testify the substitution effect and total effect caused by an associated wage increase. From the Slutsky equation, in order to isolate the substitution effect, we force the maternal real income unchanged during each rise in wage. From the results, as we expected, maternal work and childcare are substitutes, that is to say, as the wage or the opportunity cost of taking care of a child (or the price of taking care of a child) increases, a typical rural mother tends to work more in the nonagricultural or migratory type of work while spend less time in taking care her child. In other words, a mother substitutes between childcare and work, from our simulation, this substitution results in worse child health. Also, because maternal work type is an inferior good and the childcare normal good, as the price of childcare (or wage) increases, the income effect reinforces the substitution effect, the total effect means further less childcare time and more nonagricultural or migratory work. Therefore, from the table, after we release the condition of the fixed real income, it further results in worse child health. So, the total effect of a wage increase reinforces individual's choice of nonagricultural type of work and discourages her from giving a high quantity of childcare time. As a result, from simulating a small wage increase, we find that the wage increase in the nonagricultural sector is one of the reasons driving rural female labor force into the nonagricultural sector and making the rural children worse off.

The dynamic structure of the model allows us to perform the simulation in the long run. In this process, the simulated values of the lagged endogenous variables on the left hand side of the equation are updated in the simulation of the next period. From table 17, one particular thing we notice is that in the long run the marginal effects of various subsidies on the work type and childcare choices seem to amplify. Also, substitution effect as a result of wage increase also tends to increase over time. In addition, when it

comes to child health, these marginal effects also tend to enlarge. In other words, food price subsidy or medical care subsidy that increases the real income in rural areas will make children and mothers better off even in the long run in these areas.

Policy Simulations for Health Prevention Measures

Table 16 and 18 also describe the simulation results associated with a change of the health care provision quantity and quality. We use the number of health care facility, travel time to the closest facility and government subsidized insurance as the measures of health care provision quantity, and the quality is reflected by the waiting time. Our objective is to test the impacts of increasing the health care provision quantity and quality on child health and maternal employment decisions. Not surprisingly, overall, the results are similar to the results of food price subsidy and medical care subsidy. That is, as number of health care facility increases or the travel time decreases, the rural children will be better off in terms of their health conditions and, at the same time, their mothers will more likely to focus on the agricultural type of work and less likely to work in the nonagricultural sector or migrate into urban areas for jobs (the marginal effects are shown by bold numbers in each table). The increase of health insurance coverage and quality of care also has the same effects. In addition, the marginal effects tend to enlarge over time, that is to say, the rural households will be better off even in the long run if we target on the health projects that are aimed to increase the quantity and quality of the health care provision.

CHAPTER 7 DISCUSSION AND FUTURE WORK

Policy Implications and Conclusions

This study reveals some important findings of the effects of Chinese rural mothers' work type choices (such as agricultural work, nonagricultural work or migratory work), maternal care, and child nutritional input decisions on the evolution of health status of school-age children in China. First, the study provides evidence of the importance of joint estimation of maternal decisions and child outcomes by controlling for both permanent and time-varying unobserved heterogeneity. By capturing both types of heterogeneity components that possibly influence maternal decisions with regard to her work, childcare, nonmedical nutritional inputs and child health, we are able to take care of the endogeneity bias and show that alternative maternal decisions play an important role in predicting the health status of children before they become fully independent. Therefore, we are able to give more accurate predictions and simulations that portrait the trend of child health development and maternal employment in rural areas.

Also, unlike previous studies that also use the measure of work type that is unique to Chinese household and find that the effect of different work types in rural areas may impact rural children's health status differently. In addition, the structure of the model also allows us to capture both the short-term and long-term effects of maternal employment and childcare. Also, the structure of the dynamic model allows us to predict future labor market conditions in rural areas of China. For example, based on the model parameters, the given values and imputed values of exogenous variables, we simulate the proportion of rural labor force for ten waves. What we find is, based on the current development of China, the percentage of agricultural labor force will become around

37.15 and the proportion of rural mothers engaged in the nonagricultural and migratory working sector will increase to 26.86 and 18.06 respectively. That means, based on the current trend, the so called rural areas in China will gradually shrink, which will bring big impacts on both agricultural and nonagricultural industries in rural areas. Overall, in this study, we would like to draw attention especially to some of our findings: 1. Labor-intensive nonagricultural and migratory employment lead to a decrease in overall health in the long run relative to the agricultural employment or home production, and mothers engaged in the agricultural sector generally experience a decreased probability of having an unhealthy child compared to those working in the nonagricultural sector and in cities. 2. Health prevention measures that increase the quantity and quality of health care provision and subsidies that reduce food prices and medical care costs will decrease the odds of maternal nonagricultural work and increase mothers' willingness to spend more time in childcare, which is beneficial to children's health development even in the long run. 3. Small wage increases in the nonagricultural sector will actually worsen child health conditions, as rural mothers substitute between work and childcare and the income effect reinforces the substitution effect. 4. By modeling employment and maternal care as joint and dynamic decisions and controlling both permanent and time-variant heterogeneities, conclusions are more accurate than or even different from those achieved by the single static equation analysis in terms of the impact of employment and childcare alternatives on children's health stock accumulations

In general, the results of this study highlight the importance of analyzing the maternal agricultural/nonagricultural/migratory employment and maternal care as a simultaneous decision making process. It indicates that maternal employment if properly planned with adequate childcare time (induced by appropriate exogenous forces) may actually be beneficial to rural children's health productions in term of growth and

nutrition. This conclusion suggests that the mechanisms through which maternal employment and childcare affect child development should be explored in greater depth to have more insights about the tradeoffs between employment and childcare.

Future Work

This study highlights the importance of the maternal care on child health. However, because of the limitations of the model and data, there are still many important factors that can be explored more in detail in the future. For example, the model didn't carefully capture the effect of father and grandparent. Although father's decision seems to be irrelevant to the child health production, his employment choice may still affect the care giver or the mother's decision with regard to work and childcare. In other words, a father may impose indirect effects on his child's health. Therefore, in the future, the model can be further improved by incorporating father's labor participation behavior. In addition, the effect of grandparent on child health development seems to be vague by ignoring the grandparent's health status. Despite of the invisibility of grandparent's health in our data, we may still employ different indices such as grandparent's or mother's age to infer the physical condition of grandparent. By controlling for the physical condition, the effect of grandparent on child will be more robust.

Another thing we may examine in the future is the effect of other types of facilities in the community. In this study, we conclude the positive impact of health facility on child health. We didn't investigate other infrastructures such as school and gym in the community. We are not sure if it is the health facility that keeps mothers from working away from their children or it is the improvement of education or living stands that actually influences the rural mothers' employment choice.

In addition, mother's fertility decision may also determine her child's future health development. In rural areas of China, the penalty of having a second child may

induce mothers to pay more attention to the second child they gave birth to. In general, the results of this paper contribute to the debate over rural woman's labor participation and child health, but the debate is still going on due to the uncertainty associated with child health and maternal behaviors.

Table 1: Descriptive Statistics for Entry and Attrition

Wave	Number of subjects	Drop-outs	Rejoiners	Drop-out rate
1997	3014			
2000	2216	1259	461	41.77%
2004	1249	1302	335	58.75%
2006	1047	520	318	41.63%

# of individual followed at least 2 years: 2201
# of individual followed at least 3 years: 796
# of individual followed at least 4 years: 401
# of person-year observation: 7526

Table 2: Description of Constructed Variables

Diagnosed hypertension	Average of three systolic blood pressure measurements was >= 140mm Hg and/or average diastolic blood pressure was >= 90mm Hg and/or respondent was taking medication to lower blood pressure
Physical impairments	Suffering from any of the impairments below: goiter/angular stomatitis; loss of one arm or the use of 1 arm; loss of both arms or use of both arms; loss of one leg or the use of 1 leg; loss of both legs or use of both legs; blindness in one eye; blindness in both eyes.
Health shock	Suffering from any of the symptoms below: fever, sore throat, cough; headache, dizziness, rash, dermatitis; diarrhea, stomachache; joint pain, muscle pain; heart disease/chest pain; other symptoms
Relocate	Indicator of house/apartment from state and moving into new house/apartment since last survey.

Table 3: Descriptive Statistics for Endogenous Variables

Variables	1997	2000	2004	2006
Maternal Work Type				
No Work: 0	181	231	80	43
	(8.22%)	(10.50%)	(10.05%)	(10.72%)
Agricultural Work in Village: 1	1297	1221	409	193
	(58.93%)	(55.47%)	(51.38%)	(48.13%)
Nonagricultural Work in Village: 2	351	364	143	77
	(15.95%)	(16.54%)	(17.96%)	(19.20%)
Ag. and Nonag. Work in Village: 3	153	157	72	37
	(6.95%)	(7.13%)	(9.05%)	(9.23%)
Nonag. Work in city/town: 4	219	228	92	51
	(9.95%)	(10.36%)	(11.56%)	(12.72%)
Maternal Care Time				
None/Extremely Low: 0	181	191	78	42
	(8.22%)	(8.68%)	(9.80%)	(10.47%)
Low: 1	1075	1104	423	219
	(48.84%)	(50.16%)	(53.14%)	(54.61%)
Moderate :2	718	689	240	117
	(32.62%)	(31.30%)	(30.15%)	(29.18%)
High: 3	227	217	55	23
	(10.31%)	(9.86%)	(6.91%)	(5.74%)
Child Health Shock				
Without Shock: 0	2103	2057	719	359
	(95.55%)	(93.46%)	(90.33%)	(89.53%)
With Shock: 1	98	144	77	42
	(4.45%)	(6.54%)	(9.67%)	(10.47%)

Table 3: Descriptive Statistics for Endogenous Variables Cont'

Variables	1997	2000	2004	2006
Child Self-reported Health Status				
Excellent: 3	495	486	157	75
	(22.49%)	(22.08%)	(19.72%)	(18.70%)
Good: 2	1380	1312	454	225
	(62.70%)	(59.61%)	(57.04%)	(56.11%)
Fair: 1	277	349	158	81
	(12.59%)	(15.86%)	(19.85%)	(20.20%)
Poor: 0	49	54	27	20
	(2.23%)	(2.45%)	(3.39%)	(4.99%)
Child HAZ	-0.552	-0.671	-0.902	-1.041
	(1.140)	(1.121)	(1.097)	(1.178)
Total Maternal Income/1000 (Yuan)	5.368	6.276	8.240	9.199
	(4.767)	(5.958)	(10.910)	(8.512)
Child's Nutritional Input Z-score	-0.126	-0.065	0.031	0.018
	(0.941)	(1.189)	(1.218)	(0.993)

Table 4: Descriptive Statistics for Exogenous Variables

Variables	1997	2000	2004	2006
Mather's Demographic Characteristics				
Mother diagnosed hypertension (1-0)	0.129	0.163	0.143	0.131
	(0.335)	(0.369)	(0.350)	(0.338)
Mother's work intensity level (1-6)	2.857	3.049	3.295	3.341
	(0.997)	(1.054)	(1.085)	(1.223)
Mother's weight (kg)	53.654	55.103	55.705	55.769
	(8.041)	(8.625)	(8.692)	(8.580)
Mother's height (cm)	155.327	155.363	155.983	156.630
	(5.556)	(5.545)	(5.730)	(5.963)
Mother's health shock	0.225	0.289	0.323	0.407
	(0.417)	(0.453)	(0.328)	(0.219)
Mother's calculated age in years	35.409	38.472	40.652	41.918
	(5.981)	(6.011)	(5.191)	(4.857)
Physical impairments	0.043	0.042	0.068	0.079
	(0.203)	(0.200)	(0.252)	(0.270)
Mother has a primary education (1-0)	0.345	0.334	0.330	0.281
	(0.476)	(0.472)	(0.471)	(0.451)
Mother has a secondary education (1-0)	0.537	0.526	0.581	0.614
	(0.482)	(0.497)	(0.494)	(0.484)
Child's Demographic Characteristics				
Child's calculated age in years	8.906	11.888	13.597	14.131
	(3.878)	(3.891)	(3.149)	(3.026)
Male child (1-0)	0.548	0.552	0.595	0.603
	(0.481)	(0.497)	(0.491)	(0.490)
Only child (1-0)	0.479	0.481	0.498	0.562
	(0.498)	(0.504)	(0.512)	(0.497)
Child has a primary education (1-0)	0.396	0.723	0.814	0.875
	(0.489)	(0.448)	(0.389)	(0.330)
Child has a secondary education (1-0)	0.198	0.501	0.632	0.647
	(0.398)	(0.498)	(0.483)	(0.480)
Neighborhood Characteristics				
Recreation facility available in the neighborhood (1-0)	0.185	0.221	0.248	0.252
	(0.251)	(0.364)	(0.335)	(0.351)
Free market available in the neighborhood (1-0)	0.461	0.492	0.617	0.752
	(0.498)	(0.511)	(0.489)	(0.452)
Electricity available in the neighborhood (1-0)	0.774	0.786	0.794	0.812
	(0.169)	(0.120)	(0.124)	(0.191)
Tap water available in the neighborhood (1-0)	0.404	0.434	0.514	0.613
	(0.491)	(0.496)	(0.501)	(0.488)

Table 4: Descriptive Statistics for Exogenous Variables Cont'

Variables	1997	2000	2004	2006
Urbanization Characteristics				
Community near open trade area/city (1-0)	0.412	0.427	0.468	0.479
	(0.492)	(0.491)	(0.498)	(0.489)
Community has telephone service (1-0)	0.786	0.884	0.837	0.895
	(0.411)	(0.320)	(0.370)	(0.307)
Community has paved road (1-0)	0.485	0.538	0.582	0.607
	(0.501)	(0.499)	(0.494)	(0.489)
Community is near bus station (1-0)	0.610	0.629	0.651	0.677
	(0.472)	(0.488)	(0.487)	(0.495)
Distance to nearest train station (km)	54.940	52.035	45.343	44.016
	(63.753)	(65.902)	(62.127)	(60.201)
Number of households in community	431.472	437.612	441.498	452.3584
	(253.594)	(220.314)	(230.156)	(199.015)
Wage/day for female worker in community	12.934	13.330	18.009	23.731
	(6.044)	(7.125)	(6.723)	(7.973)
% labor force engaged in agriculture	56.165	54.732	49.018	46.862
	(32.447)	(32.688)	(31.218)	(31.491)
% labor force outside of town for more than one month	12.045	14.187	15.872	16.775
	(15.538)	(16.471)	(16.095)	(16.901)
% labor force in enterprise with 20 people or more	19.628	21.305	22.039	21.224
	(25.749)	(29.308)	(26.554)	(23.618)
% labor force in enterprise with 20 people or less	4.556	4.951	6.208	7.413
	(8.677)	(7.904)	(8.846)	(9.581)
Real Food Prices				
Free market price - common rice (2006 Yuan)	2.376	2.487	2.948	2.981
	(0.634)	(0.539)	(0.489)	(0.523)
Free market price - common veg (2006 Yuan)	1.186	1.281	1.529	1.748
	(0.522)	(0.571)	(0.630)	(0.748)
Free market price - pork (2006 Yuan)	16.622	16.221	18.273	19.289
	(2.925)	(2.514)	(2.745)	(2.729)
Free market price - milk (2006 Yuan)	6.871	6.851	7.109	7.762
	(3.132)	(2.611)	(2.719)	(2.772)
Free market price - egg (2006 Yuan)	2.186	2.283	2.341	2.389
	(0.674)	(0.647)	(0.584)	(0.619)

Table 4: Descriptive Statistics for Exogenous Variables Cont'

Variables	1997	2000	2004	2006
Measures of Health Care				
HH receives one-child subsidy last year (1-0)	0.570	0.535	0.518	0.516
	(0.496)	(0.573)	(0.502)	(0.514)
Child has medical insurance (1-0)	0.212	0.226	0.240	0.316
	(0.736)	(0.629)	(0.427)	(0.434)
Number of health care facility around household	1.714	1.713	1.433	1.322
	(0.745)	(0.771)	(0.609)	(0.556)
Household's travel time by bike to closest facility	10.646	10.893	11.983	12.612
	(9.812)	(11.508)	(10.928)	(10.772)
Household's minimum cost to travel to facility	1.061	1.171	1.384	1.400
	(1.782)	(1.448)	(1.491)	(1.489)
Household's average waiting time for health worker	11.339	9.736	9.015	8.635
	(15.238)	(14.682)	(12.928)	(11.931)
Needed medicines available in area (1-0)	0.914	0.906	0.894	0.891
	(0.103)	(0.116)	(0.151)	(0.148)
Minimum cost to child for cold/flu treatment	16.241	20.705	31.697	39.787
	(22.833)	(30.347)	(48.310)	(50.045)
Grandparent in the neighborhood (1-0)	0.301	0.309	0.357	0.348
	(0.461)	(0.462)	(0.479)	(0.477)
Number of health facility in Community	1.307	1.236	1.234	1.227
	(0.947)	(0.966)	(0.790)	(1.075)
Distance of the closest health facilities in Community	0.207	0.218	0.312	0.325
	(0.791)	(0.782)	(0.615)	(0.601)

Table 5: Multinomial Logit Regression on Maternal Work Type with Unobserved Heterogeneity (UH)

	Ag Work			Nonag Work		
Variables	**Coefficient**		**S.E.**	**Coefficient**		**S.E.**
Last period's child health	-0.183	***	0.128	0.245	**	0.132
Mother engages in ag. work last period	2.369	***	0.187	-2.157	***	0.341
Mother engages in nonag. work last period	1.513	***	0.252	3.757	***	0.333
Mother engages in both work last period	0.467	***	0.245	0.831	**	0.556
Mother engages in migratory work last period	-1.092		0.278	-0.682	*	0.427
Previous period's childcare time: Low	0.011	***	0.169	0.043	***	0.204
Previous period's childcare time: Moderate	-0.023		0.021	0.015	*	0.039
Previous period's childcare time: High	-0.160	***	0.234	-0.208	**	0.270
Last period's child health shock	0.019	***	0.012	0.012	*	0.010
Mother Characteristics						
Mother's weight (kg)	0.017	***	0.25	0.022	***	0.017
Mother's height (cm)	0.013	**	0.028	0.018	**	0.019
Mother's age	-0.032	*	0.008	-0.082		0.011
Mother's age squared	-0.002		0.002	-0.005		0.003
Mother receives primary education	-0.747		0.232	-1.106	***	0.252
Mother receives secondary education	0.050	***	0.210	0.095	**	0.233
Mother has impairments	0.007		0.007	-0.023	***	0.019
Mother diagnosed hypertension	-0.054	**	0.012	-0.094	***	0.017
Mother health shock	0.016		0.006	0.012		0.008
Child Characteristics						
Child's age	0.060	*	0.124	0.135	**	0.198
Child's age squared	-0.004	*	0.034	-0.014	***	0.006
Male child	0.316	**	0.153	0.231	**	0.124
Only child	0.519	***	0.236	0.382	**	0.235
Child receives primary education	-0.024		0.114	0.183	**	0.126
Child receives secondary education	0.034		0.113	0.277	**	0.165
Exogenous Factors						
Measures of Urbanization						
Number of household in neighborhood	-0.083	***	0.018	-0.052	**	0.012
Wage/day for female worker	-0.016	***	0.012	0.018	***	0.011
Community near open trade area/city	-0.081		0.041	0.010	*	0.006
% labor force in enterprise with 20 people or more	-0.018	***	0.021	0.015	***	0.013

Table 5: Multinomial Logit Regression Results of Work type with UH Cont'

Variables	Ag Work Coefficient		S.E.	Nonag Work Coefficient		S.E.
% labor force in enterprise with 20 people or less	0.012	**	0.006	0.021	***	0.015
Distance (Km) to nearest train station	0.007	**	0.008	0.015	***	0.009
% Work force engaged in agriculture	0.025	***	0.012	-0.028	***	0.014
% labor force outside of town for more than one month	0.018		0.003	-0.012	***	0.009
Community near bus stop	-0.015		0.014	0.036	**	0.020
Community has paved road	0.006	**	0.003	0.017	*	0.012
Household was relocated since last survey	0.018	*	0.021	0.281	***	0.085
Household Amenity						
Recreation facility available in the neighborhood	0.014	***	0.012	0.012	***	0.011
Tap water available in the neighborhood	0.231	***	0.163	0.275	***	0.192
Electricity available in the neighborhood	0.132	**	0.091	0.145	***	0.086
Free market available in the neighborhood	0.074	*	0.021	0.053	**	0.007
Measure of Heath Care Provision						
Household's minimum cost to travel to facility	0.010	***	0.008	0.021	***	0.013
Needed generally medicines available	0.044		0.378	0.003		0.004
Minimum cost to child for cold/flu treatment	0.082	**	0.126	0.118	***	0.171
Number of health facility in community	0.065	**	0.055	0.036	**	0.025
Distance of the closest hospital in community	0.012	**	0.026	0.028	***	0.026
Child has medical insurance	0.289	***	0.124	0.126	**	0.173
Number of health facility around household	0.083	**	0.048	0.062	***	0.043
Household's travel time by bike to closest facility	0.019	**	0.034	0.047	**	0.045
Household's minimum waiting time	0.045	**	0.028	0.029	***	0.035
Grandparent around	0.014	*	0.018	0.025	**	0.027
Food Price						
CPI adjusted price - common rice	0.056	**	0.022	0.034	**	0.059
CPI adjusted price - veg commonly eaten	0.015	**	0.018	0.028	**	0.153
CPI adjusted price - pork	0.042	*	0.026	0.055	**	0.034
CPI adjusted price - fresh milk	0.052	**	0.044	0.071	***	0.046
CPI adjusted price - egg	-0.062		0.023	-0.047		0.037

Table 5: Multinomial Logit Regression Results of Work type with UH Cont'

Variables	Both Work Coefficient		S.E.	Migratory Work Coefficient		S.E.
Last period's child health	0.275	***	0.136	0.389	**	0.201
Mother engages in ag. work last period	-1.975	***	0.294	-0.458	***	0.230
Mother engages in nonag. work last period	1.858	**	0.436	0.920	***	0.244
Mother engages in both work last period	1.081	***	0.541	0.544	*	0.360
Mother engages in migratory work last period	-0.748		0.468	1.203	***	0.202
Previous period's childcare time: Low	0.052	**	0.027	0.167	***	0.121
Previous period's childcare time: Moderate	0.016		0.024	0.011		0.012
Previous period's childcare time: High	-0.202	*	0.316	-0.306	**	0.216
Last period's child health shock	0.010		0.016	-0.007	*	0.011
Mother Characteristics						
Mother's weight (kg)	0.025	***	0.018	0.021	**	0.028
Mother's height (cm)	0.015	**	0.024	0.017	***	0.035
Mother's age	0.003		0.014	0.056		0.084
Mother's age squared	-0.001		0.000	-0.008	**	0.003
Mother receives primary education	-1.173	***	0.315	-1.275	*	0.451
Mother receives secondary education	0.086	*	0.331	1.213	***	0.373
Mother has impairments	-0.020	**	0.052	-0.037	**	0.014
Mother diagnosed hypertension	-0.098	***	0.016	-0.113	**	0.025
Mother health shock	0.017		0.013	-0.021	*	0.017
Child Characteristics						
Child's age	0.161	**	0.152	0.159	***	0.149
Child's age squared	-0.013	***	0.005	-0.011	**	0.004
Male child	0.192	***	0.120	0.138	***	0.106
Only child	0.315	**	0.265	0.245	***	0.276
Child receives primary education	0.176	*	0.125	0.217	**	0.117
Child receives secondary education	0.285	*	0.187	0.392	**	0.172
Exogenous Factors						
Measures of Urbanization						
Number of household in neighborhood	0.015		0.021	-0.026	**	0.031
Wage/day for female worker	0.017	**	0.017	0.025	**	0.016
Community near open trade area/city	0.015	***	0.012	0.028	*	0.051
% labor force in enterprise with 20 people or more	0.009	***	0.011	0.005	**	0.002

Table 5: Multinomial Logit Regression Results of Work type with UH Cont'

Variables	Both Work Coefficient		S.E.	Migratory Work Coefficient		S.E.
% labor force in enterprise with 20 people or less	0.011	***	0.008	-0.002		0.003
Distance (Km) to nearest train station	0.014	***	0.012	0.027	***	0.022
% Work force engaged in agriculture	-0.027	***	0.018	-0.032	***	0.024
% labor force outside of town for more than one month	-0.014		0.004	0.189	***	0.083
Community near bus stop	0.112	***	0.054	0.159	**	0.067
Community has paved road	0.008		0.006	0.016	*	0.004
Household was relocated since last survey	0.128	***	0.031	0.188	***	0.075
Household Amenity						
Recreation facility available in the neighborhood	0.011		0.028	0.012		0.011
Tap water available in the neighborhood	0.271	***	0.109	0.191	*	0.077
Electricity available in the neighborhood	0.151	**	0.082	0.148	***	0.038
Free market available in the neighborhood	0.051	**	0.048	0.047	***	0.052
Measure of Heath Care Provision						
Household's minimum cost to travel to facility	0.025	***	0.014	0.038	***	0.012
Needed generally medicines available	0.005		0.004	-0.014		0.003
Minimum cost to child for cold/flu treatment	0.127	***	0.082	0.154	**	0.116
Number of health facility in community	0.027	***	0.062	0.023	*	0.048
Distance of the closest hospital in community	0.039	***	0.065	0.062	*	0.079
Child has medical insurance	0.114	*	0.121	0.092	**	0.081
Number of health facility around household	0.068	***	0.055	0.051	**	0.036
Household's travel time by bike to closest facility	0.051	**	0.041	0.074	**	0.054
Household's minimum waiting time	0.021	***	0.031	0.018	**	0.027
Grandparent around	0.036	***	0.035	0.065	***	0.023
Food Price						
CPI adjusted price - common rice	0.032	**	0.028	0.015	*	0.020
CPI adjusted price - veg commonly eaten	0.030	**	0.073	0.045	**	0.098
CPI adjusted price - pork	0.058	***	0.042	0.079	**	0.053
CPI adjusted price - fresh milk	0.069	***	0.034	0.082	***	0.053
CPI adjusted price - egg	-0.057		0.069	-0.089		0.028

*** significant at 1% level, ** significant at 5% level, * significant at 10% level.
Reference category is no work.

Table 6: Multinomial Logit Regression on Childcare Time with Unobserved Heterogeneity (UH)

Variables	Low Maternal Care Coefficient		S.E.	Mod. Maternal Care Coefficient		S.E.
Last period's child health	-0.029	*	0.084	-0.081	**	0.087
Mother engages in ag. work last period	0.043	**	0.116	0.084	**	0.134
Mother engages in nonag. work last period	-0.069	*	0.189	-0.121	*	0.212
Mother engages in both work last period	-0.078	**	0.214	-0.167	***	0.257
Mother engages in migratory work last period	-0.091	**	0.169	-0.198	**	0.249
Previous period's childcare time: Low	1.172	***	0.143	-0.630	***	0.147
Previous period's childcare time: Moderate	0.820	***	0.188	0.965	***	0.188
Previous period's childcare time: High	0.751		0.216	0.351	**	0.208
Last period's child health shock	0.020	**	0.011	0.029	***	0.014
Mother Characteristics						
Mother's weight (kg)	0.014	***	0.012	0.071	**	0.016
Mother's height (cm)	-0.013		0.004	-0.043		0.005
Mother's age	0.025		0.072	0.045	**	0.077
Mother's age squared	-0.002	***	0.002	-0.005	**	0.003
Mother receives primary education	-0.047		0.017	0.022	**	0.069
Mother receives secondary education	0.014	*	0.015	0.027	*	0.053
Mother has impairments	-0.048		0.058	-0.013	*	0.062
Mother diagnosed hypertension	-0.111	**	0.015	-0.178	**	0.012
Mother health shock	-0.068		0.067	-0.077		0.017
Child Characteristics						
Child's age	-0.059	**	0.031	-0.068	**	0.045
Child's age squared	0.003	**	0.003	0.007	**	0.003
Male child	0.124		0.135	0.154	**	0.138
Only child	0.428		0.286	0.637	**	0.292
Child receives primary education	-0.059	*	0.012	-0.071	**	0.021
Child receives secondary education	0.057		0.010	-0.083		0.010
Exogenous Factors						
Measures of Urbanization						
Number of household in neighborhood	0.002	**	0.001	0.005	**	0.001
Wage/day for female worker	-0.029	***	0.018	-0.050	**	0.024
Community near open trade area/city	-0.051	*	0.034	-0.069		0.042
% labor force in enterprise with 20 people or more	-0.025	**	0.025	-0.038	**	0.022

Table 6: Multinomial Logit Regression on Childcare Time with UH Cont'

Variables	Low Maternal Care Coefficient		S.E.	Mod. Maternal Care Coefficient		S.E.
% labor force in enterprise with 20 people or less	0.012	*	0.024	0.026	***	0.033
Distance (Km) to nearest train station	-0.051		0.016	-0.087	***	0.017
% Work force engaged in agriculture	0.063	***	0.022	0.075	***	0.034
% labor force outside of town for more than one month	-0.026	*	0.028	-0.035	*	0.029
Community near bus stop	-0.078		0.012	-0.083	**	0.013
Community has paved road	-0.328		0.033	0.128		0.031
Household was relocated since last survey	-0.079	*	0.054	-0.126	**	0.048
Household Amenity						
Recreation facility available in the neighborhood	0.027	**	0.015	0.039	*	0.017
Tap water available in the neighborhood	0.035	**	0.031	0.041	*	0.042
Electricity available in the neighborhood	0.026		0.015	0.038	**	0.016
Free market available in the neighborhood	0.048	**	0.056	0.062	**	0.061
Measure of Heath Care Provision						
Household's minimum cost to travel to facility	-0.047	**	0.031	-0.063	**	0.034
Needed generally medicines available	0.068	*	0.037	0.072		0.038
Minimum cost to child for cold/flu treatment	-0.126	**	0.016	-0.167	*	0.021
Number of health facility in community	0.092	**	0.043	0.121	**	0.046
Distance of the closest hospital in community	0.072	***	0.042	0.063	**	0.041
Child has medical insurance	0.016	**	0.024	0.023	**	0.021
Number of health facility around household	0.064	**	0.029	0.095	**	0.037
Household's travel time by bike to closest facility	-0.043		0.035	-0.072	***	0.042
Household's minimum waiting time	0.015		0.021	0.025	***	0.023
Grandparent around	-0.168	***	0.153	-0.294	***	0.196
Food Price						
CPI adjusted price - common rice	0.096	**	0.121	0.128	***	0.114
CPI adjusted price - veg commonly eaten	-0.111	**	0.078	-0.144	***	0.083
CPI adjusted price - pork	-0.124	**	0.026	-0.167	**	0.027
CPI adjusted price - fresh milk	-0.088	***	0.037	-0.094	***	0.042
CPI adjusted price - egg	-0.054	*	0.023	-0.079	*	0.024

Table 6: Multinomial Logit Regression on Childcare Time with UH Cont'

Variables	High Maternal Care Coefficient		S.E.
Last period's child health	-0.247	*	0.109
Mother engages in ag. work last period	0.092	**	0.091
Mother engages in nonag. work last period	-0.140	*	0.236
Mother engages in both work last period	-0.181	***	0.291
Mother engages in migratory work last period	-0.212	**	0.319
Previous period's childcare time: Low	-1.473	***	0.177
Previous period's childcare time: Moderate	0.863	**	0.194
Previous period's childcare time: High	1.582	***	0.241
Last period's child health shock	0.038	***	0.024
Mother Characteristics			
Mother's weight (kg)	0.084	***	0.027
Mother's height (cm)	-0.055		0.016
Mother's age	0.073		0.050
Mother's age squared	-0.005		0.001
Mother receives primary education	0.051	***	0.064
Mother receives secondary education	0.063	***	0.048
Mother has impairments	-0.032	**	0.055
Mother diagnosed hypertension	-0.194	**	0.014
Mother health shock	-0.036		0.008
Child Characteristics			
Child's age	-0.072		0.038
Child's age squared	0.004	*	0.004
Male child	0.163	**	0.170
Only child	0.782	***	0.353
Child receives primary education	-0.085	**	0.023
Child receives secondary education	-0.098	**	0.013
Exogenous Factors			
Measures of Urbanization			
Number of household in neighborhood	0.012		0.008
Wage/day for female worker	-0.064	***	0.019
Community near open trade area/city	-0.054		0.049
% labor force in enterprise with 20 people or more	-0.067	***	0.021

Table 6: Multinomial Logit Regression on Childcare Time with UH Cont'

	High Maternal Care		
Variables	**Coefficient**		**S.E.**
% labor force in enterprise with 20 people or less	-0.038	**	0.032
Distance (Km) to nearest train station	-0.091	***	0.029
% Work force engaged in agriculture	0.082	**	0.027
% labor force outside of town for more than one month	-0.043	**	0.024
Community near bus stop	-0.095	**	0.014
Community has paved road	0.165	**	0.039
Household was relocated since last survey	-0.218	*	0.067
Household Amenity			
Recreation facility available in the neighborhood	0.046	***	0.016
Tap water available in the neighborhood	0.027	***	0.034
Electricity available in the neighborhood	0.021	***	0.019
Free market available in the neighborhood	0.084	**	0.057
Measure of Heath Care Provision			
Household's minimum cost to travel to facility	-0.079	*	0.041
Needed generally medicines available	0.082	***	0.044
Minimum cost to child for cold/flu treatment	-0.184	**	0.032
Number of health facility in community	0.158	**	0.048
Distance of the closest hospital in community	0.049	*	0.037
Child has medical insurance	0.034	**	0.035
Number of health facility around household	0.117		0.029
Household's travel time by bike to closest facility	-0.094	***	0.045
Household's minimum waiting time	0.054	**	0.032
Grandparent around	-0.359	***	0.241
Food Price			
CPI adjusted price - common rice	0.154	*	0.127
CPI adjusted price - veg commonly eaten	-0.161	**	0.106
CPI adjusted price - pork	-0.185	**	0.033
CPI adjusted price - fresh milk	-0.114	***	0.048
CPI adjusted price - egg	-0.092		0.039

*** significant at 1% level, ** significant at 5% level, * significant at 10% level.
Reference category is minimum childcare time.

Table 7: Logit Regression on Child Health Shock with Unobserved Heterogeneity (UH)

Variables	Coefficient		S.E.
Previous period's child health	-0.812	*	0.124
Childcare time: Low	0.215		0.232
Childcare time: Moderate	-0.312	**	0.204
Childcare time: High	-0.375	**	0.276
Previous period's child nutritional input	-0.042	*	0.025
Mother Characteristics			
Mother's weight (kg)	0.235		0.078
Mother's height (cm)	-0.216	***	0.051
Mother's age	-0.524	***	0.063
Mother's age squared	0.081		0.014
Mother receives primary education	-0.318	***	0.417
Mother receives secondary education	-0.551	***	0.329
Mother has impairments	0.613	***	0.543
Mother diagnosed hypertension	0.341	***	0.065
Mother health shock	0.476	***	0.122
Child Characteristics			
Child's age	2.887	**	0.551
Child's age squared	0.021		0.016
Male Child	0.052	***	0.026
Only Child	-2.168	**	1.249
Child's weight (kg)	-0.572	***	0.194
Child's height (cm)	-0.280	**	1.286
Child receives primary education	-2.428	***	0.895
Child receives secondary education	-2.836	**	0.884

*** significant at 1% level, ** significant at 5% level,
* significant at 10% level.

Table 7: Logit Regression on Child Health Shock with UH Cont'

Variables	Coefficient		S.E.
Measure of Heath Care Provision			
Household's minimum cost to travel to facility	0.373	***	0.361
Needed generally medicines available	-0.796	***	0.184
Minimum cost to child for cold/flu treatment	0.031	***	0.012
Number of health facility in community	-0.407	***	0.245
Distance of the closest hospital in community	0.852	***	0.031
Child has medical insurance	0.095	***	0.017
Number of health facility around household	-0.548	***	0.314
Household's travel time by bike to closest facility	0.227	***	0.051
Household's minimum waiting time	-0.424	***	0.129
Grandparent around	1.291		1.167

*** significant at 1% level, ** significant at 5% level,
* significant at 10% level.

Table 8: OLS Regression on Maternal Log Income with UH

Variables	Coefficient		S.E.
Previous period's child health	0.011	***	0.021
Mother engages in ag. work	-0.083		0.075
Mother engages in nonag. work	1.039	***	0.081
Mother engages in both work	1.042	***	0.092
Mother engages in migratory work	1.668	***	0.081
Mother Characteristics			
Mother's weight (kg)	-0.021		0.002
Mother's height (cm)	0.017	***	0.011
Mother's age	0.347	***	0.181
Mother's age squared	-0.011	***	0.002
Mother receives primary education	0.073		0.038
Mother receives secondary education	0.147	**	0.353
Mother has impairments	0.015		0.016
Mother diagnosed hypertension	-0.139	**	0.082
Mother health shock	-0.141		0.152
Child Characteristics			
Child's age	0.032	*	0.026
Child's age squared	-0.001	**	0.001
Male Child	0.032	**	0.033
Only Child	0.181	**	0.067
Child receives primary education	0.026		0.025
Child receives secondary education	-0.026		0.024
Exogenous Factors			
Measures of Urbanization			
Number of household in neighborhood	-0.002	*	0.009
Wage/day for female worker	0.039	***	0.011
Community near open trade area/city	0.143	***	0.071
% labor force in enterprise with 20 people or more	0.065	**	0.026
% labor force in enterprise with 20 people or less	-0.016		0.007
Distance (Km) to nearest train station	0.002		0.002
% Work force engaged in agriculture	-0.021	**	0.014
% labor force outside of town for more than one month	0.018	**	0.012
Community near bus stop	0.027	*	0.021
Community has paved road	0.051	**	0.079
Household was relocated since last survey	0.065	**	0.056

*** significant at 1% level, ** significant at 5% level,
* significant at 10% level.

Table 9: OLS Regression on Child Nutrition Z score with UH

Variables	Coefficient	S.E.
Previous period's child health	-0.052 **	0.027
Child health shock	0.047 *	0.046
Childcare time: Low	-0.074 **	0.031
Childcare time: Moderate	0.026 *	0.023
Childcare time: High	0.129 ***	0.041
Maternal income	0.078 **	0.019
Mother Characteristics		
Mother's weight (kg)	0.045 **	0.016
Mother's height (cm)	-0.036	0.017
Mother's age	0.031 ***	0.025
Mother's age squared	-0.003 ***	0.001
Mother receives primary education	0.045	0.040
Mother receives secondary education	0.029 **	0.039
Mother has impairments	-0.377	0.452
Mother diagnosed hypertension	-0.086 **	0.021
Mother health shock	-0.025	0.016
Child Characteristics		
Child's age	-0.061 ***	0.029
Child's age squared	0.008 *	0.002
Male child	0.157 ***	0.143
Only child	0.194 ***	0.056
Child's weight (kg)	0.089 *	0.012
Child's height (cm)	0.015 **	0.056
Child receives primary education	-0.018	0.026
Child receives secondary education	0.021 *	0.025

*** significant at 1% level, ** significant at 5% level,
* significant at 10% level.

Table 10: OLS Regression on Child Health Outcome with UH

Variables	HAZ Coefficient		S.E.	Good Health Coefficient		S.E.	Fair/Poor Health Coefficient		S.E.
Last period's child health									
HAZ	1.275	***	0.212						
Good health				0.408	**	0.067	0.228	**	0.079
Poor health				0.294	**	0.084	0.346	**	0.086
Maternal income	0.146	***	0.214	-0.041		0.067	-0.085	**	0.064
Childcare time: Low	-0.024	*	0.012	-0.164	*	0.594	-1.352	**	0.684
Childcare time: Moderate	0.056	**	0.015	-0.705	**	0.611	-1.519	***	0.727
Childcare time: High	0.147	***	0.016	-0.804	**	0.766	-1.742	**	0.925
Child health shock	-0.342	*	0.289	0.512	**	0.415	1.437	**	1.512
Child nutritional input									
Nutrition Z-score	0.128	***	0.031						
High nutritional input				-0.124	**	0.114	-0.288	**	0.162
Medium nutritional input				-0.152	**	0.085	-0.197	**	0.108
Interactions									
Nutrition Z-score × HAZ	-0.035	***	0.042						
Nutrition Z-score × Good health				-0.026	**	0.031	-0.018	*	0.024
Nutrition Z-score × Fair/Poor health				-0.014		0.027	-0.025		0.087
Nutrition Z-score × Health shock	0.047	**	0.039	0.186		0.174	0.270	*	0.165
Time × Low childcare time	0.008		0.005	-0.052	**	0.060	-0.071	**	0.053
Time × Moderate childcare time	-0.014	**	0.011	-0.021		0.017	-0.028		0.012

Table 10: OLS Regression on Child Health Outcome with UH Cont'

Variables	HAZ Coefficient		S.E.	Good Health Coefficient		S.E.	Fair/Poor Health Coefficient		S.E.
Time × High childcare time	-0.031	**	0.029	0.161	**	0.148	0.247	**	0.129
Child Characteristics									
Child's age	-0.216	***	0.015	0.029	**	0.026	0.084	***	0.046
Child's age squared	0.011	***	0.008	-0.004	*	0.032	-0.006	**	0.041
Male child	-0.139	**	0.014	0.154	*	0.126	0.261	*	0.183
Only child	0.048	**	0.036	-0.072	**	0.123	-0.109	***	0.155
Child's weight (kg)	0.135	**	0.001	-0.116		0.056	-0.192		0.082
Child's height (cm)	-0.018		0.023	-0.023		0.012	-0.096		0.027
Child receives primary education	0.141	***	0.021	-0.036		0.061	-0.106		0.103
Child receives secondary education	0.166	***	0.034	-0.284	*	0.121	-0.323	***	0.184
Mother Characteristics									
Mother's weight (kg)	0.019	*	0.051	-0.031	*	0.026	-0.040	**	0.032
Mother's height (cm)	0.042	***	0.051	-0.092	***	0.035	-0.144	***	0.047
Mother's age	0.027	**	0.085	-0.172		0.371	-0.231		0.394
Mother's age squared	-0.004	*	0.008	0.015		0.002	-0.026		0.013
Mother receives primary education	0.017	***	0.012	-0.682		0.891	-0.882		0.937
Mother receives secondary education	0.022	**	0.014	-0.714	**	1.194	-1.369	**	1.266
Mother has impairments	-0.014	**	0.009	0.798		1.176	1.513		1.591
Mother diagnosed hypertension	-0.085	**	0.091	0.673	**	0.240	0.811	***	0.289
Mother health shock	-0.089		0.062	0.015		0.031	0.022	**	0.027
Exogenous Factors									
Food Prices									
CPI adjusted price - common rice	0.221	**	0.120	-0.473	*	0.341	-0.563		0.485

Table 10: OLS Regression on Child Health Outcome with UH Cont'

Variables	HAZ Coefficient		S.E.	Good Health Coefficient		S.E.	Fair/Poor Health Coefficient		S.E.
CPI adjusted price - veg commonly eaten	-0.053		0.028	0.276	**	0.292	0.457	**	0.397
CPI adjusted price - pork	-0.078		0.053	0.362	**	0.374	0.395	**	0.412
CPI adjusted price - egg	-0.041	**	0.025	0.416	**	0.192	0.812		0.218
Measure of Heath Care Provision									
Household's minimum cost to travel to facility	-0.062		0.031	0.264		0.198	0.327		0.251
Needed generally medicines available	0.167	**	0.038	-0.451	**	0.263	-0.543	***	0.286
Minimum cost to child for cold/flu treatment	-0.049	**	0.021	0.127	**	0.112	0.136	**	0.128
Number of health facility in community	0.037	**	0.033	-0.156	**	0.178	-0.221	**	0.229
Distance of the closest hospital in community	-0.036	*	0.032	0.328		0.221	0.413	*	0.341
Child has medical insurance	0.052	**	0.037	-0.259	***	0.204	-0.319	***	0.283
Number of health facility around household	0.042	**	0.019	-0.131	***	0.187	-0.214	***	0.166
Household's travel time by bike to closest facility	-0.081	***	0.024	0.047	***	0.029	0.078	***	0.035
Household's minimum waiting time	0.095	*	0.016	-0.135	**	0.111	-0.187	**	0.089
Grandparent around	-0.037		0.025	-0.509		0.182	-0.512		0.172

*** significant at 1% level, ** significant at 5% level, * significant at 10% level.

Table 11: One Wave Simulation of Health Outcomes for Alterative Maternal Work Types

	With unobserved heterogeneity		Without unobserved heterogeneity	
Self-Reported Health (Good)				
No work	61.98	(4.84)	60.61	(4.24)
Agricultural work	63.52	(4.79)	61.93	(3.61)
Nonagricultural work	61.25	(4.63)	59.64	(4.45)
Agricultural & nonagricultural work	60.34	(4.37)	60.43	(4.73)
Migratory work	59.85	(5.11)	62.19	(4.66)
Self Reported Health (Fair/Poor)				
No work	15.89	(3.64)	17.26	(2.21)
Agricultural work	13.94	(3.57)	15.13	(2.74)
Nonagricultural work	17.02	(4.13)	18.03	(3.35)
Agricultural & nonagricultural work	17.87	(3.76)	17.72	(2.68)
Migratory work	19.16	(3.84)	16.01	(3.47)
Average HAZ index				
No work	-0.614	(1.082)	-0.751	(0.995)
Agricultural work	-0.505	(1.118)	-0.664	(0.963)
Nonagricultural work	-0.632	(1.095)	-0.893	(1.024)
Agricultural & nonagricultural work	-0.698	(1.115)	-0.829	(0.837)
Migratory work	-0.807	(1.152)	-0.742	(0.916)

Note: The simulation is over one wave; the results are based on the outcome in the last wave. Standard errors are in the parentheses.

Table 12: Four Wave Simulation of Health Outcomes for Alterative Maternal Work Types

	With unobserved heterogeneity		Without unobserved heterogeneity	
Self-Reported Health (Good)				
No work	56.84	(4.55)	55.47	(4.16)
Agricultural work	58.67	(4.61)	56.08	(3.59)
Nonagricultural work	55.98	(4.97)	54.37	(4.43)
Agricultural & nonagricultural work	55.03	(4.81)	55.32	(4.51)
Migratory work	54.49	(5.06)	56.64	(4.67)
Self Reported Health (Fair/Poor)				
No work	24.13	(3.72)	26.40	(2.18)
Agricultural work	21.75	(3.65)	24.34	(2.81)
Nonagricultural work	25.18	(4.16)	27.79	(3.32)
Agricultural & nonagricultural work	26.09	(3.79)	26.43	(2.59)
Migratory work	27.82	(3.49)	25.67	(3.84)
Average HAZ index				
No work	-1.051	(1.117)	-1.188	(0.978)
Agricultural work	-0.937	(1.128)	-1.096	(0.959)
Nonagricultural work	-1.074	(1.109)	-1.235	(1.014)
Agricultural & nonagricultural work	-1.169	(1.151)	-1.217	(0.835)
Migratory work	-1.285	(1.164)	-1.107	(0.917)

Note: The simulation is over four waves, the results are based on the outcome in the last wave. Standard errors are in the parentheses.

Table 13: Differences in the Long Run Effects of Maternal Work Types on Child Health

	No work		Agricultural work		Nonagricultural work		Ag. & Nonag. work	
△Self-Reported Health (Good)								
Agricultural work	-1.83	(3.36)						
Nonagricultural work	**0.86**	(4.54)	**2.69**	(3.17)				
Agricultural & nonagricultural work	1.81	(3.71)	3.64	(5.37)	0.95	(3.01)		
Migratory work	2.35	(4.46)	**4.18**	(4.10)	1.49	(3.91)	0.54	(4.12)
△Self-Reported Health (Fair/Poor)								
Agricultural work	2.35	(4.04)						
Nonagricultural work	-1.53	(3.48)	-3.88	(3.92)				
Agricultural & nonagricultural work	-2.12	(4.02)	-4.47	(4.91)	-0.59	(2.01)		
Migratory work	-4.27	(5.11)	**-6.62**	(4.15)	-2.74	(3.51)	-2.15	(4.78)
△Average HAZ index								
Agricultural work	-0.114	(1.117)						
Nonagricultural work	**0.023**	(1.154)	0.137	(1.263)				
Agricultural & nonagricultural work	0.118	(1.092)	0.232	(1.114)	0.095	(1.162)		
Migratory work	**0.234**	(1.109)	**0.348**	(1.082)	0.211	(0.972)	0.116	(0.981)

Note: The simulation is over four waves, the results are based on the outcome in the last wave. Standard errors are in the parentheses.

Table 14: Simulation of Child Health for Alterative Maternal Work and Childcare Decisions

	None/Extremely Low		Low		Medium		High	
Self-Reported Health (Good)								
No work	46.52	(5.08)	51.72	(4.18)	55.16	(4.74)	57.57	(4.61)
Agricultural work	49.24	(5.12)	53.25	(4.84)	56.73	(4.86)	59.23	(4.87)
Nonagricultural work	51.14	(5.17)	55.06	(4.96)	58.55	(5.15)	61.16	(5.14)
Agricultural & nonagricultural work	53.31	(4.83)	56.72	(5.01)	59.91	(4.98)	62.84	(4.95)
Migratory work	51.02	(5.76)	54.84	(4.98)	58.14	(5.11)	59.35	(5.06)
Self-Reported Health (Fair/Poor)								
No work	37.27	(4.21)	30.02	(3.91)	25.76	(3.84)	22.49	(3.61)
Agricultural work	34.02	(4.29)	28.14	(3.85)	23.85	(3.51)	20.68	(3.75)
Nonagricultural work	31.14	(4.41)	26.01	(4.17)	21.39	(4.17)	18.82	(3.99)
Agricultural & nonagricultural work	28.37	(4.52)	24.27	(4.15)	20.08	(3.88)	17.29	(4.13)
Migratory work	32.56	(3.92)	27.05	(4.16)	21.94	(4.11)	19.73	(3.87)
Average HAZ index								
No work	-1.452	(1.149)	-1.179	(1.212)	-1.014	(1.076)	-0.876	(1.065)
Agricultural work	-1.337	(1.241)	-1.062	(1.085)	-0.901	(1.151)	-0.752	(1.118)
Nonagricultural work	-1.218	(1.093)	-0.947	(1.176)	-0.787	(1.167)	-0.659	(0.954)
Agricultural & nonagricultural work	-1.114	(1.047)	-0.829	(1.283)	-0.654	(1.128)	-0.518	(0.872)
Migratory work	-1.266	(1.238)	-0.982	(1.115)	-0.819	(0.974)	-0.704	(1.155)

Note: The simulation is over four waves, the results are based on the outcome in the last wave. Standard errors are in the parentheses

Table 15: One Wave Policy Simulation for Income and Substitution Effect

	Height-for-Age Index		P. of Ag Work		P. of Nonag. Work		P. of Migratory Work		P. of Low Childcare Time		P. of Mod/High Childcare Time	
Total Effect		△		△		△		△		△		△
Wage (Yuan)												
Wage Level: 0-10	-0.5302		72.6		9.35		5.36		44.61		38.36	
Wage Level: 10-20	-0.5535	**-0.0233**	65.71	**-6.89**	17.29	**7.94**	10.23	**4.87**	48.32	**3.71**	34.09	**-4.27**
Wage Level: 20-30	-0.5727	**-0.0192**	56.92	**-8.79**	26.03	**8.74**	14.49	**4.26**	53.04	**4.72**	29.06	**-5.03**
Pure Income Effect												
Milk Price Level (Yuan)												
Price Level: 0-5	-0.5318		63.08		15.41		10.72		43.62		40.83	
Price Level: 5-10	-0.5537	**-0.0219**	59.22	**-3.86**	18.22	**2.81**	12.16	**1.44**	46.19	**2.57**	36.87	**-3.96**
Price Level: 10-15	-0.5702	**-0.0165**	56.35	**-2.87**	22.08	**3.86**	14.13	**1.97**	49.05	**2.86**	34.09	**-2.78**
Pure Income Effect												
Regular Medical Cost (Yuan)												
Cost Level: 0-10	-0.5284		68.12		10.79		6.91		47.08		39.21	
Cost Level: 10-20	-0.5585	**-0.0301**	66.34	**-1.78**	12.35	**1.56**	8.92	**2.01**	49.2	**2.12**	36.37	**-2.84**
Cost Level: 20-30	-0.5806	**-0.0221**	63.62	**-2.72**	14.81	**2.46**	10.76	**1.84**	50.85	**1.65**	34.43	**-1.94**
Substitution Effect												
Wage (Holding Real Income Constant)												
Wage Level: 0-10	-0.5302		72.6		9.35		5.36		44.63		38.36	
Wage Level: 10-20	-0.5486	**-0.0184**	66.64	**-5.96**	16.44	**7.09**	8.65	**3.29**	46.28	**1.65**	35.94	**-2.42**
Wage Level: 20-30	-0.5612	**-0.0126**	58.72	**-7.92**	24.82	**8.38**	12.76	**4.11**	48.35	**2.07**	32.84	**-3.1**

Note: The simulation is over one wave; the results are based on the outcome in the last wave. Standard errors are in the parentheses.

Table 16: One Wave Policy Simulation for Health Prevention Measures

	Height-for-Age Index		P. of Ag Work		P. of Nonag. Work		P. of Migratory Work		P. of Low Childcare Time		P. of Mod/High Childcare Time	
		△		△		△		△		△		△
Number of Health Care Facility												
Number of Facility 0	-0.6376		60.39		22.42		10.23		54.07		31.45	
Number of Facility 1-2	-0.5461	**0.0916**	64.31	**3.92**	20.11	**-2.31**	8.01	**-2.22**	51.05	**-3.02**	33.86	**2.41**
Number of Facility >2	-0.4951	**0.0510**	66.25	**1.94**	18.52	**-1.59**	6.47	**-1.54**	48.82	**-2.23**	36.03	**2.17**
Waiting Time (Min)												
Waiting time 0-10	-0.5847		63.65		21.69		9.48		52.83		34.85	
Waiting time 10-20	-0.5271	**0.0576**	67.39	**3.74**	18.78	**-2.91**	7.47	**-2.01**	50.42	**-2.41**	38.63	**3.78**
Waiting time >20	-0.4865	**0.0406**	70.21	**2.82**	16.51	**-2.27**	6.05	**-1.42**	48.15	**-2.27**	41.16	**2.53**
Travel Time to the Closest Health Facility (Min)												
Travel time 0-10	-0.5052		65.16		22.82		7.98		49.63		41.22	
Travel time 10-20	-0.5432	**-0.0380**	64.15	**-1.01**	24.66	**1.84**	9.25	**1.27**	51.54	**1.91**	39.26	**-1.96**
Travel time > 20	-0.5625	**-0.0193**	62.27	**-1.88**	25.97	**1.31**	11.02	**1.77**	53.05	**1.51**	38.17	**-1.09**
Government Subsidized Insurance												
Child Health Insurance 0	-0.6277		57.19		25.35		11.61		52.93		38.92	
Child Health Insurance 1	-0.5485	**0.0792**	62.69	**5.5**	20.86	**-4.49**	8.32	**-3.29**	51.38	**-1.55**	40.85	**1.93**

Note: The simulation is over one wave; the results are based on the outcome in the last wave. Standard errors are in the parentheses.

Table 17: Four Wave Policy Simulation for Income and Substitution Effect

	Height-for-Age Index		P. of Ag Work		P. of Nonag. Work		P. of Migratory Work		P. of Low Childcare Time		P. of Mod/High Childcare Time	
Total Effect		△		△		△		△		△		△
Wage (Yuan)												
Wage Level: 0-10	-0.9895		67.42		10.22		6.17		48.84		35.24	
Wage Level: 10-20	-1.0234	**-0.0339**	58.64	**-8.78**	19.17	**8.95**	11.32	**5.15**	54.62	**5.78**	28.47	**-6.77**
Wage Level: 20-30	-1.0591	**-0.0357**	49.13	**-9.51**	28.68	**9.51**	16.13	**4.81**	60.69	**6.07**	20.49	**-7.98**
Pure Income Effect												
Milk Price Level (Yuan)												
Price Level: 0-5	-1.0203		56.05		16.56		11.32		45.83		38.98	
Price Level: 5-10	-1.0529	**-0.0326**	50.16	**-5.89**	20.54	**3.98**	13.55	**2.23**	48.86	**3.03**	34.52	**-4.46**
Price Level: 10-15	-1.0796	**-0.0267**	45.21	**-4.95**	25.13	**4.59**	16.02	**2.47**	53.05	**4.19**	29.51	**-5.01**
Pure Income Effect												
Regular Medical Cost (Yuan)												
Cost Level: 0-10	-1.0325		66.21		11.14		7.62		49.93		37.91	
Cost Level: 10-20	-1.0795	**-0.0470**	63.62	**-2.59**	13.78	**2.64**	10.26	**2.64**	53.25	**3.32**	34.62	**-3.29**
Cost Level: 20-30	-1.1098	**-0.0303**	59.86	**-3.76**	17.15	**3.37**	12.51	**2.25**	55.27	**2.02**	32.13	**-2.49**
Substitution Effect												
Wage (Holding Real Income Constant)												
Wage Level: 0-10	-0.9897		67.42		10.22		6.17		48.84		35.24	
Wage Level: 10-20	-1.0153	**-0.0256**	60.39	**-7.03**	17.74	**7.52**	10.21	**4.04**	51.16	**2.32**	31.21	**-4.03**
Wage Level: 20-30	-1.0341	**-0.0188**	50.84	**-9.55**	26.91	**9.17**	15.15	**4.94**	54.22	**3.06**	26.19	**-5.02**

Note: The simulation is over four waves, the results are based on the outcome in the last wave. Standard errors are in the parentheses.

Table 18: Four Wave Policy Simulation for Health Prevention Measures

	Height-for-Age Index		P. of Ag Work		P. of Nonag. Work		P. of Migratory Work		P. of Low Childcare Time		P. of Mod/High Childcare Time	
		△		△		△		△		△		△
Number of Health Care Facility												
Number of Facility 0	-1.1639		57.08		28.54		12.95		58.83		28.14	
Number of Facility 1-2	-1.0607	**0.1032**	61.95	**4.87**	25.06	**-3.48**	10.08	**-2.87**	54.45	**-4.38**	31.92	**3.78**
Number of Facility >2	-0.9985	**0.0622**	64.34	**2.39**	22.78	**-2.28**	8.12	**-1.96**	51.26	**-3.19**	35.33	**3.41**
Waiting Time (Min)												
Waiting time 0-10	-1.0378		58.64		25.02		11.85		56.04		31.54	
Waiting time 10-20	-0.9722	**0.0655**	62.96	**4.32**	20.26	**-4.76**	8.94	**-2.91**	52.43	**-3.61**	36.15	**4.61**
Waiting time >20	-0.9154	**0.0568**	64.98	**2.02**	17.05	**-3.21**	7.19	**-1.75**	49.19	**-3.24**	39.44	**3.29**
Travel Time to the Closest Health Facility (Min)												
Travel time 0-10	-0.9576		60.65		24.13		9.68		54.95		39.33	
Travel time 10-20	-1.0014	**-0.0438**	58.38	**-2.27**	26.32	**2.19**	11.86	**2.18**	52.04	**-2.91**	36.41	**-2.92**
Travel time > 20	-1.0267	**-0.0253**	54.92	**-3.46**	28.15	**1.83**	13.81	**1.95**	54.19	**2.15**	34.49	**-1.92**
Government Subsidized Insurance												
Child Health Insurance 0	-1.0314		50.67		28.15		13.12		55.53		36.96	
Child Health Insurance 1	-0.9066	**0.1248**	58.25	**7.58**	22.36	**-5.79**	9.05	**-4.07**	53.36	**-2.17**	40.52	**3.56**

Note: The simulation is over one wave; the results are based on the outcome in the last wave. Standard errors are in the parentheses.

Table 19: Comparison of Actual and Predicted Mean Values of Child Health Outcome

Variables	2000		2004		2006	
	Actual	Predicted	Actual	Predicted	Actual	Predicted
Average Child HAZ						
	-0.671	-0.698	-0.902	-0.965	-1.041	-1.082
	(1.121)	(1.025)	(1.097)	(1.114)	(1.178)	(1.069)
Self-reported Health Status						
Good	59.61%	59.98%	57.04%	57.62%	56.11%	56.78%
	(42.26)	(42.39)	(37.14)	(37.01)	(35.45)	(35.22)
Fair/Poor	18.31%	17.92%	23.42%	24.16%	25.19%	25.94%
	(35.51)	(36.24)	(31.28)	(31.16)	(29.73)	(29.69)

Note: The simulation is over four waves with standard errors in parenthesis. Standard errors (in parentheses) are bootstrapped parametrically with 100 draws

REFERENCES

Aizer, Anna. 2004 “Home Alone: Supervision After School and Child Behavior.” *Journal of Public Economics* 88(9-10): 1835-1848.

Angrist, Joshua. 2001. “Estimation of Limited Dependent Variable Models With Dummy Endogenous Regressions: Simple Strategies for Empirical Practice.” *Journal of Business & Economic Statistics* 19(1): 2-16.

Anderson, Patricia, Kristin Butcher, and Phillip Levine. 2003. "Maternal employment and over-weight children." *Journal of Health Economics* 22(3): 477-504.

Arellano, Manuel and Stephen Bond. 1991. “Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations.” *Review of Economic Studies* 58(2): 277-97.

Aslam, Monazza and Geeta Kingdon, 2010. “Parental Education and Child Health - Understanding the Pathways of Impact in Pakistan.” Centre for the Study of African Economies, University of Oxford, CSAE Working Paper Series No.2010-16

Baker, Michael, Jonathan Gruber, and Kevin Milligan. 2008. "Universal childcare, maternal labor supply and child well-being." *Journal of Political Economy* 116(4): 709-745.

Becker, Gary. S. and Gregg Lewis. 1973. “Interaction between the Quantity and Quality of Children.” *Journal of Political Economy* 81: 279-288.

Becker, Gary. 1965. “A Model of Allocation of Time.” *Economic Journal* 75: 493-517.

Behrman, Jere R. 1990. “The Action of Human Resources and Poverty on One Another: What We Have Yet to Learn.” Living Standards Measurement, Working Paper World Bank No. 74.

Behrman, Jere R. and Anil B. Deolalikar. 1988. “Health and Nutrition.” *Handbook of Development Economics* 74: 474-81.

Bernal, Raquel. 2008. "The effect of maternal employment and childcare on children's cognitive development." *International Economic Review* 49(4): 1173-1209.

Bhargava, Alok and John D. Sargan. 1983. “Estimating Dynamic Random Effects Models from Panel Data Covering Short Time Periods.” *Econometrica* 51(6): 1635-59.

Blau, David M., David K. Guilkey and Barry M. Popkin. 1996. “Infant Health and the Labor Supply of Mothers.” *Journal of Human Resources* 31(1): 90-139.

Blau, Francine and Adam Grossberg. 1992. "Maternal Labor Supply and Children's Cognitive Development." *The Review of Economics and Statistics* 74(3): 474-481.

Bramlett, Matthew D. and Stephen J. Blumberg. 2007. “Family Structure and Children’s Physical and Mental Health.” *Health Affairs* 26(2): 549-558.

Caryn Bredenkamp. 2008. “Health Reform, Population Policy and Child Nutritional Status in China.” World Bank Policy Research Working Paper No. 4587.

Chen, Zai-Yu. 2009. "The Health Status of the left-behind Children in Rural China." *Chinese Journal of Population Science* 5: 95-102.

Chen, Yuyu and Hongbin Li. 2006. “Mother's Education and Child Health: Is There a Nurturing Effect?” Chinese University of Hong Kong, Department of Economics, Working Paper No.00021

Currie, Janet and V. Joseph Hotz. 2004. "Accidents Will Happen? Unintentional Injury, Maternal Employment, and Childcare Policy" *Journal of Health Economics* 23(1): 25-59.

Desai, Sonalde. P., Lindsay Chase-Lansdale and Robert T. Michael. 1989. “Mother or Market?: Effects of Maternal Employment on the Intellectual Ability of 4-Year-Old Children.” *Demography* 26: 545-62.

Engle, Patrice L. and Cynthia Breaux. 1994. “Is There a Father Instinct? Fathers’ Responsibility for Children.” New York: The Population Council.

E. Van de Poel. 2009. “The Health Penalty of China’s Rapid Urbanization.” Tinbergen Institute Discussion Paper TI 2009-016/3.

Evans, Judith L. 1995. “Men in the Lives of Children.” Coordinator’s Notebook No.16, Consultative Group on Early Childhood Care and Development.

Gaudin, James. M., and Richard Sutphen. 1993. “Foster care vs extended family care for children with incarcerated mothers.” *Journal of Offender Rehabilitation* 19: 129-147.

Gennetian, Lisa A., Heather D. Hill, Andrew S. London, and Leonard M. Lopoo. 2010. “Maternal employment and the health of low-income young children.” *Journal of Health Economics* 29(3): 353-363.

Glick, Peter and David E. Sahn. 1998. “Maternal Labor Supply and Child Nutrition in West Africa.” *Oxford Bulletin of Economics and Statistics* 60(3): 325 -355.

Glick, Peter. 2002. “Women’s Employment and Its Relation to Children’s Health and Schooling in Developing Countries: Conceptual Links, Empirical Evidence and Policies.” Cornell University working paper.

Gordon, Rachel A., Robert Kaestner, and Sanders Korenman. 2007. "The effects of maternal employment on child injuries and infectious disease." *Demography* 44(2): 307-333.

Guo, Xuguang, Barry M. Popkin, Thomas A.Mroz, and Fengying Zhai. 1999. “Food Price Policy Can Favorably Alter Macronutrient Intake in China.” *Journal of Nutrition* 129(5): 994-1001.

Hare, Denise. 1999. “Women’s Economic Status in Rural China: Household Contributions to Male-Female Disparities in the Wage-Labor Market.” *World Development* 27(6): 1011-1029.

Hassan, H Dib, Xilong Pan and Hong Zhang. 2008. “Evaluation of the new rural cooperative medical system in China: is it working or not?” *International Journal for Equity in Health* 2008 7: 17-25.

Hayslip, Bert and Patricia L. Kaminski. 2005. "Grandparents raising their grandchildren: a review of the literature and suggestions for practice." *The Gerontologist*. 45: 262-269.

Hoddinott, John and Lawrence Haddad. 1995. “Does Female Income Share Influence Household Expenditure Patterns: Evidence from Cote d’Ivoire.” *Bulletin* 57: 77-96.

Hongbin, Li, Xianguo Yao, Junsen Zhanga, and Li-An Zhou. 2005. "marental childcare and children’s educational attainment: evidence from China." *Applied Economics* 37: 2067–2076.

Jacoby, Hanan. 1993. “Shadow Wages and Peasant Family Labor Supply: An Econometric Application to the Peruvian Sierra.” *Review of Economic Studies* 60(4): 903-921.

James-Burdumy, Susanne. 2005. “The Effect of Maternal Labor Force Participation on Child Development.” *Journal of Labor Economics* 23(1): 177-211.

Kaestner, Robert, and Hope Corman. 1995. “The impact of child health and family inputs on child cognitive development.” NBER Working Paper No. 5257.

Keane, Michael and Smith Anthony A. 2003. “Generalized Indirect Inference for Discrete Choice Models.” Yale University Working Paper.

Kirby, James B.. 2002. “The influence of parental separation on smoking initiation in adolescents.” *Journal of Health Soc Behavior* 43(1): 56-71.

Liu, Hong and Zhong Zhao. 2011. "Parental Job Loss and Children’s Health: Ten Years after the Massive Layoff of the SOEs’ Workers in China." IZA Discussion Papers No. 5846, Institute for the Study of Labor (IZA).

Liu, Jin. 2008. "Effects of maternal labor supply on children’s health outcomes in rural China." *Chinese Journal of Economic Study* 9: 120-128.

Liu, Yuanli, Shanlian Hu, Wei Fu, and William C. Hsiao. 1996. “Is community financing necessary and feasible in rural China?” *Health Policy* 38: 155-171.

Lohmar, Bryan, Scott Rozelle, and Changbao Zhao. 2001. “The Rise of Rural to Rural Labor Markets in China.” *Asian Geographer* 20: 101-123.

McGuire, Judith S. and Barry M. Popkin. 1990. “Helping Women Improve Nutrition in the Developing World.” World Bank Technical Paper No.114, Cambridge University Press, Cambridge.

Mehra, Rekha and Sarah Gammage. 1999. “Trends, countertrends, and gaps in women’s employment.” *World Development* 27(3): 533-550.

Meng, Xin. 2000. “Labor Market Reform in China.” Cambridge: Cambridge University Press.

Morrill, Melinda S.. 2011. “The effects of maternal employment on the health of school-age children.” *Journal of Health Economics* 30(2): 240-257.

Ng, Shu Wen. 2005. “Being a Little Emperor or Empress Matters Equally: The One Child Policy and Child Nutrition in China.” UNC chapel Hill Population Center Working Paper.

Poel, Ellen, Ahmad R. Hosseinpoor, Niko Speybroeck, Tom V. Ourti, and Jeanette Vega. 2008. “Socioeconomic inequality in malnutrition in developing countries.” *Bulletin of the World Health Organization* 86: 241-320.

Rozelle, Scott, Li Guo, Minggao Shen, Amelia Hughart, and John Giles. 1999. “Leaving China’s Farms: Survey Results of New Paths and Remaining Hurdles to Rural Migration.” *China Quartly* 158: 367-393.

Risti, Permani. 2011. “Revisiting the Link between Maternal Employment and School-Aged Children Health Status in Developing Countries: An Instrumental Variable Approach.” University of Adelaide, School of Economics Working Paper: 2011-2021.

Ruhm, Christopher. 2004. “Parental employment and child cognitive development.” *The Journal of Human Resources* 39(1): 155-192.

Ruhm, Christopher. 2008. "Maternal employment and adolescent development." *Labor Economics*. 15(5): 958-983.

Sicular, Terry and Yaohui Zhao. 2004. “Earnings and Labor Mobility in Rural China: Implications for China’s WTO Entry.” University of Western Ontario, Economic Policy Research Institute Working Papers No. 20028.

Solomon, Jennifer C. and Marx Jonathan. 1995. “To grandmother’s house we go: health and school adjustment of children raised solely by grandparents.” *Gerontologist* 35: 386-394.

Waldfogel, Jane, Wen-Jui Han, and Jeanne Brooks-Gunn. 2002. “The effects of early maternal employment on child cognitive development.” *Demography* 39(2): 369-392.

Wagner, Natascha and Matthias Riegery. 2011. “Polygamy and Child Health Do babies get sick if daddy has many wives?” Graduate Institute of International and Development Studies, Geneve, Working Paper.

Yang, Zhou, Donna B. Gilleskie, and Edward C. Norton. 2009. “Health Insurance, Medical Care, and Health Outcomes: A Model of Elderly Health Dynamics.” *Journal of Human Resources* 44(1): 47–114.

Zhang, Linxiu, Alan De Brauw, and Scott Rozelle. 2004. “China’s Rural Labor Market Development and Its Gender Implications.” *China Economic Review* 15: 230-247.