THREE ESSAYS ON ECONOMIC INSECURITY AND CHILD DEVELOPMENT

by

Weiyang (Nancy) Kong

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To children who want to be heard

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Abstract

Studies of economic insecurity often neglect children. This dissertation examines the effects of parental economic insecurity on children's development. In Chapter 2, I investigate the causal relationship between parental economic insecurity and non-cognitive skills of 2 to 5 years olds. I draw data from Statistics Canada National Longitudinal Survey of Children and Youth from 2000 to 2005, and employ OLS and individual fixed effects estimation. I find that when parents worry about money, their children are more likely to be hyperactive and anxious. The effects on children are comparable to a divorce shock. I propose the intergenerational effects are transmitted through direct mirroring of parents' anxiety, and indirect effects of parenting styles. I demonstrate parents are more likely to use negative parenting styles and less likely to use positive strategies when they worry about money. In Chapter 3, I explore the causal relationship between parental economic insecurity and child weight gain. I use the natural experiment of China State-Owned Enterprise Reform that laid off 34 millions workers in the state sector and employ the difference-in-difference methodology with individual fixed effects with panel data from the China Health and Nutrition Survey. Compared to the non-state sector, boys whose parents work for the state sector experience weight gain significantly. The results persist among families that never lost jobs, emphasizing the effects of anticipation of job loss, rather than the actual job loss. Quantile regressions suggest that overweight boys are likely to gain more weight. In Chapter 4, I investigate the effects of large negative income shocks on dietary intakes within Chinese families. I study families with both girls and boys, and examine the changes in intakes of boys versus girls, fathers versus mothers, and parents versus children. Using the macronutrient daily intake standard, I find that significant carbohydrate intakes and overall energy intakes rise in response to negative income shocks. The food allocation is in the order of fathers, sons, daughters and mothers. The results highlight the intra-household inequality in Chinese families.

List of Abbreviations Used

BMI	Body Mass Index
CPI	Consumer Price Index
DD	Difference-in-Differences
CHNS	Chinese Health and Nutrition Survey
FE	Fixed Effects
NLSCY	National Longitudinal Survey of Children and Youth
PMK	Person Most Knowledgeable (about the child)

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Chapter 1

Introduction

The dissertation consists of three essays investigating parental economic insecurity and child outcomes in Canada and China.

A large body of literature suggests economic insecurity causes mental and physical health problems. Little research has been done on intergenerational effects of economic insecurity on children in the families. My thesis fills the gap and suggests that economic anxiety not only is harmful to adults who are suffering from it, but has negative effects on children's development. I also investigate the channel through which parental economic insecurity passes onto children.

My first essay explores the relationship between economic insecurity and children's inattentive/hyperactive and anxious behaviours in Canada. Using data from the National Longitudinal Survey of Children and Youth (NLSCY), 47% of households with young children worry about whether they have enough money to support their families.

Results suggest that hyperactivity and anxiety are positively associated with parental economic insecurity. The size of the association between parental economic insecurity and children's inattentive/hyperactive behaviours are comparable to divorce shocks. Boys exhibit more inattentive/hyperactive behaviours than girls, but girls are more sensitive to changes in parental economic insecurity.

A potential channel through which parental economic insecurity affects children is their parenting behaviour. Less positive interaction and consistent parenting, more irrational and punitive parenting strategies are apparent when parents experience economic insecurity.

In the second essay, I explore the causal relationship between parental economic insecurity and children's weight gain using the natural experiment of massive layoffs of 34 million employees in the Chinese state sector in the late 1990s due to unanticipated state-owned enterprise reform, which marked the end of the "iron

rice bowl" or guarantee of employment security.

Using the provincial and year-level layoff rates and income loss from the layoffs, I estimate its effects on children's body mass measures adjusting for age and gender growth standards. A continuous difference-in-difference estimation with individual fixed effects indicates that if the expected economic loss from layoff increases by 10 percentage points, a 10-year-old boy increases his body mass measure distribution from the median to the 86th percentile.

The results persist even for boys whose parents kept their jobs, indicating the importance of anxiety about potential loss, as well as the experience of actual loss. Quantile regressions then demonstrate that economic insecurity has greater effects on boys at a higher distribution of waist-to-height ratio, which suggests that overweight children are more severely affected by parental economic insecurity. Girls' weight outcomes are not significantly affected by the layoffs, suggesting a gender difference in response to parental economic insecurity. After accounting for the intergenerational effects, this essay shows higher public health costs associated with economic insecurity than previous studies have suggested.

The third essay investigates within family the effects of parental income shocks on individual's dietary intake. Drawing on large-scale panel data from the China Health and Nutrition Survey from 1991 to 2011, I examine the macronutrient intakes of 2 to 17-year-old siblings of mixed-sex and their parents in 3,244 families. Gender disparity in carbohydrate intakes accounts for 15 percentage points in child sample, 30 percentage points in adolescents, and 50 percentage points between parents using the Dietary Reference Intakes standards. The essay further shows that when families experience negative income shocks, food is allocated in the order of fathers, sons, daughters and mothers. Gender inequality of intra-household resource allocation is heightened in the event of large income losses.

Chapter 2

Parental economic insecurity and children's non-cognitive skills. A panel study of 2 to 5 year-olds in Canada

2.1 Introduction

Many families with young children in Canada experience economic insecurity, despite having both parents working full-time in the paid labour market. For example, micro-data from the National Longitudinal of Children and Youth (NLSCY) indicate that 47 percent of children live in families that worry about not having enough money. This paper explores how parental economic insecurity affects non-cognitive outcomes of their 2 to 5 year old children.

2.1.1 Motivation

It is well recognized that economic deprivation has a negative impact on children's well-being. Children in low-income families tend to have poorer health and test scores (Dahl & Lochner, 2012), and are more likely to drop out of school and experience teenage pregnancy (Brooks-Gunn & Duncan, 1997). These economics papers focus on income and poverty.

However, Gershoff, Aber, Raver and Lennon (2007) argue that it is important to look beyond income when studying child development. They include material hardship (food insecurity, residential instability, inadequacy of medical care, and months of financial troubles) in addition to income, and find that both income and material hardship influence children's cognitive skills. This influence is mediated through parent investment in children, parental stress and positive parenting behaviour. Gershoff et al. allege that income effects estimated in the earlier economic literature were confounded by material hardship.

In this paper, we propose that family income and material hardship are not the only 'economic' variables that affect children. Our goal is to demonstrate that after

controlling for income, economic insecurity experienced by parents also influences children's development.

2.1.2 Economic insecurity

Low current income is correlated with, but is distinct from worries about future income. Recent studies have found that the risk of unemployment reduces life satisfaction more than the financial loss caused by unemployment (Di Tella et al., 2003). Economic insecurity can be defined as "the anxiety produced by a lack of economic safety, i.e. by an inability to obtain protection against subjectively significant potential economic losses" (Osberg, 1998). Economic insecurity is thus due to an unprotected significant possible future economic loss that threatens people's future economic state. Osberg (2009) identified the common causes of economic insecurity as: unemployment, sickness, disability, widowhood, and old age.

Previous literature has linked adult health with economic insecurity. Rohde et al (2016), using Australian data, found that economic insecurity affects both mental health and physical health, and people are susceptible regardless of their income level. Watson, Osberg and Phipps (2016) drew upon the natural experiment of Canadian unemployment insurance benefits cut and found that this policy changed increased BMI by 3.2 points. Staudigel (2016) linked economic insecurity to anxiety, food intake and weight. These studies focused on the impact of economic insecurity on adult health, but, to the best of our knowledge, no studies have examined the possible implications of parental economic insecurity for child well-being.

Our analysis focuses on two non-cognitive outcomes of Canadian children in very early childhood (i.e., aged 2 to 5 years), an extremely important stage of life. Given the cumulative nature of human development, early life experiences are the foundation for all future development (e.g., Cunha and Heckman, 2010). Pragmatically, our choice also ensures data consistency. We use the Early Childhood Development (ECD) cohorts of the National Longitudinal Survey of Children and Youth (NLSCY), which only follows children up to the age of five.

Specifically, we study associations between parental economic insecurity and: 1) an inattention/hyperactive score and; 2) an emotion/anxiety score. Not only are

these important indicators of the child's current well-being, but Cunha and Heckman (2010) emphasize the dynamic complementarities between cognitive and non-cognitive development. For example, it is hard to learn the alphabet if you can't sit still or are overly anxious at pre-school.

The remainder of the paper is organized as follows: Section 2 describes the data, sections 3 and 4 discuss methodology and results, respectively. Section 5 examines parenting behaviour as a potential pathway from parental economic insecurity to child outcomes. Section 6 concludes.

2.2 Data description

2.2.1 NLSCY

We use data from the National Longitudinal Survey of Children and Youth (NLSCY) conducted by Statistics Canada. The NLSCY is a long-term panel study that follows Canadian children in the 10 provinces from birth to adulthood, providing a comprehensive picture of their social and family environment, emotional status, behavioural development and well-being, learning patterns and later labour market outcomes. The survey began in 1994 (cycle 1) and was conducted every two years until 2008 (cycle 8). Because the key measure for this paper (parental economic insecurity) is introduced in cycle 4, our sample is constructed using data from 2000, 2002, 2004, 2006 and 2008.

The data we use are from the Early Childhood Development (ECD) component of the NLSCY. The ' Person Most Knowledgeable' (PMK) about the child answered the survey questions (92% of PMK's are the biological mother). The ECD comprises observations from old ECD cohorts, and a new cohort for each cycle. Children from the ECD components are followed until they are 5 years old. To valid the PMK-reported measures, we limit the sample to the same PMK over time for each child.

Our analysis uses two samples: a cross-sectional sample and a longitudinal sample. The cross-sectional sample is constructed by pooling the 5 cycles together, providing 3,9711 observations in total. When pooling the cross sections, we treat

each cycle as a separate draw from the same population, generating new cross-sectional weights from the original cross-sectional weight that adjust for the sample size of each cycle. The calculation involves two steps: 1) sum the individual cross-sectional weights within each survey cycle; 2) divide the individual cross-sectional weight by the total for that cycle. In this way, cross-sectional survey weights are normalized to sum to one in each cycle. Standard errors are adjusted to account for the fact that the same child can appear more than once in the data.
The longitudinal sample consists of five panels that follow the same child from age 2 or 3 to age 4 or 5. The longitudinal sample size consists of 27,156 children in 26,969 families. Longitudinal weights are employed to account for attrition across cycles.

2.2.2 Measure of economic insecurity

Our measure of economic insecurity in the NLSCY is asked directly of the PMK: "Please tell me whether you strongly agree, agree, disagree, or strongly disagree with the following statement: You worry about whether the money you have will be enough to support your family?" We assign the value 4 to the answer "strongly agree", and 1 to "strongly disagree." Thus, a high numeric value is associated with a high level of economic insecurity. Table 2.1 shows the distribution of parental economic insecurity for our cross-sectional sample. PMKs who agree or strongly agree that they worry about money account for 48% of the sample, which suggests that almost half of the population is at least somewhat worried about whether they will have enough money to support their families. The mean is 2.5 and the standard deviation is 0.93. From a longitudinal point of view, 30 percent of the children experience changes in the level of parents being "worried about money".

2.2.3 Indices of non-cognitive skills

We use two measures of children's non-cognitive skills: an inattentive/hyperactive score, and an emotion/anxiety score. The inattention/hyperactive measure is a 12-point index that is derived from parental responses to a series of questions about age-specific behaviours of the child, such: whether the child can sit still, concentrate or settle for more than a few moments; is inattentive and easily distracted;

has difficulty waiting his or her turn, etc (see Appendix I for detail). Higher values of the index correspond to more inattentive/hyperactive behaviours.
The anxiety score is a 12-point index based on parental responses to questions about the child's emotions/anxiety, such as: whether the child is sad, unhappy, fearful or nervous, worried, tense or has trouble enjoying him/herself. A higher score associates with a higher degree of emotional disorder (again, see Appendix 1 for details).

2.2.4 Control variables

The most important control variable is income. Past literature has documented that income deprivation negatively affects children's development (Dahl & Lochner, 2005). In this paper, we argue that even controlling for income, the anxiety and worry of parents about current economic needs or potential future economic difficulties may still affect children's development. We measure family income using real log equivalent annual household income before taxes after transfers. This is household income divided by the square root of household size. This equivalence scale is widely used in OECD publications. It means that the amount of income needed by a four-person family is twice that needed by one person (given the economies of scale available to multi-person families).
Child, PMK and household characteristics are also included. The child controls include age, health, schooling exposure and birth-order/number of siblings. Specifically, we use a set of dummy variables for age with 'age 2' as the base. PMKs were asked, "In general, would you say this child's health is excellent, very good, good, fair or poor?" Since very few children have fair or poor health, we aggregate these categories, keep "excellent health" as the base and include the rest categories as dummy variables.
Education falls under provincial jurisdiction in Canada. Thus, variations across provinces in school starting ages, for example, can result in children of the same age being in school in some provinces but not others (see Chen, Fortin and Phipps, 2015). Thus, we include a set of dummies to indicate the child's schooling level – Junior Kindergarten (only in Ontario), Kindergarten (called Grade Primary in Nova Scotia) and Grade 1, keeping 'not yet in school' as the base.

Hanushek (1992) reported that birth order and family size affect children's educational attainment due to the variations of resource allocation within a family so, in this paper, we control for being a first-born child as well as for the number of the child's siblings.

For PMK's, we control for education, family structure and immigrant status. Specifically, we control for PMK's highest degree obtained, using secondary schooling or less as the base and including a dummy variable for a college/university degree and above. In terms of family structure, 'always-married family' is the base with dummies for lone-parent and step-parent families. A step-parent family is defined as the child living with "biological mother and step father, or biological father and step mother." Lone-parent family is defined as the child living with "one parent only." We exclude observations if the child lives with adoptive parent(s), foster parents, or does not live with a parent. These three categories combined account for less than 1% of the sample. Finally, we control for PMK immigrant status. The province of residence, and the year of survey are also controlled. We dropped observations from the territories because territories are not surveyed across all cycles. Table 2.2 reports the summary statistics of the outcome variables, measure of economic insecurity, and the control variables.

2.3 Methodology

2.3.1 Pooled OLS estimation

To investigate the relationships between children's outcomes and parental economic insecurity, we begin by pooling the years from 2000 to 2008 and conduct OLS estimations. In this pooled sample, a child can appear more than once. The baseline specification is described as below:

$$Y_i = \alpha + \beta_1 EconInsecurity_i + \beta_{\mathbf{2}} \mathbf{X_i} + \epsilon_i \tag{2.1}$$

where is the outcome (hyperactivity or anxiety) for child i, "worry about money" is treated as a continuous variable in one specification and as a set of separate dummies in a second specification. $\boldsymbol{X}$ is a vector of control variables, which includes family structure, logarithm equivalent income, number of siblings, first-born child

dummy, survey year, immigrant status, PMK education, children's health and age. We cluster the standard error at the household level to control for the same child appearing more than once in the sample. All analyses are carried out separately for girls and boys.

2.3.2 Individual fixed effects

In the OLS model, associations are identified by comparing child outcomes for otherwise observably identical children whose parents report different levels of insecurity (i.e., we compare cross-sectional observations which can include the same child more than once and/or a sibling). We cluster standard errors to account for the non-independence of such observations.

Of course, the OLS models cannot control for unobservable differences across children (e.g., genetic endowments). Thus, we also estimate individual fixed effects models exploiting the panel structure of the data to remove unchanging unobservable differences between children. In the fixed effects specification, we compare the same child's outcomes over time, and how he/she is affected by changes in parental worries about money. The model is structured as:

$$Y_{it} = \alpha + \beta_1 EconInsecurity_{it} + \beta_{\mathbf{2}}\mathbf{X_{it}} + \lambda_i + \epsilon_{it} \tag{2.2}$$

where t stands for years, and represents the permanent unobservable characteristics of child i. In this fixed effects model, we exclude time-invariant characteristics, such as immigration status, parental education and province. Thus, we estimate children's well-being on changes in parent's money worries, household income, children's health, family composition, and number of siblings.

2.4 Descriptive Results

Table 2.3 presents mean statistics for our two measures of children's non-cognitive development. The average inattentive/hyperactive (I/H) score for all children is 3.54 (of a possible 12), and the standard deviation is 2.38. As a preliminary indication of the relationship between parental economic insecurity and child outcomes, for children whose parents "strongly agree" that they are worried about money, the

average I/H score is higher (3.86); whereas, for children whose parents "strongly disagree" that they are worried about money, the average I/H score is statistically significantly lower (3.23).

The average emotion/anxiety (E/A) score for the full sample is 1.44 (out of a maximum 12), and the standard deviation is 1.59. Again, the E/A score is statistically significantly higher for children whose parents are more worried about money, from 1.32 when the parent is not worried to 1.58 when the parent is very worried.

2.5 Estimation Results

2.5.1 Inattentive/Hyperactive Behaviour Score

Table 2.4 reports both the linear probability and fixed effects estimates for the inattentive/hyperactive behaviour score. Parental "worries about money" is significant and positive in both OLS and fixed effects estimates for boys and for girls. Specification 1 uses the continuous measure for "worry about money." On average, a 1-point increase in being worried about money (on a 4-point scale) leads to a 0.20 point increase in the I/H score for girls, and a 0.16 point increase for boys (see Columns 1 and 6). In specification 2 (Table 2.4 columns 2 and 6), we break down worried about money into dummies, using "worry about money: disagree" as the base. For both girls and boys, the "strongly agree" and "agree" are highly significant and positive. Compared with "worry about money: disagree", "Strongly worry about money" increases in the I/H score by 0.31 point for girls, and 0.40-point increase for boys. For girls, the "strongly disagree" with "worry about money" has negative effects on I/H score. If we compare the differences between children in the lowest and highest categories of economic insecurity, the I/H score in "strongly worry about money" families is 0.52-point higher for girls and 0.40-point higher for boys, or 22% and 17% standard deviation higher after controlling for the observables.

In the fixed effects estimates, the association between parental money worries and child inattention/hyperactivity remains statistically significant for boys in both specification (see Table 2.4 Columns 7, and 8). The estimates in specification 1 show that a 1-point increase in parental worries about money leads to the increase

in I/H score by 0.062 point for boys. The estimates in specification 2 demonstrates that when parents strongly worry about money, the I/H score increases by 0.15 point compared with the same boy's I/H score when parents do not worry about money. The difference between highest and lowest categories suggest a 0.15-point increase in I/H, which is an 8% standard deviation difference. This result suggests that after controlling for unobserved heterogeneity across children, boys' hyperactivity increases with parental money worries, while girls' I/H scores are not significantly affected.

To better understand whether the magnitude of these effects is of potential policy relevance, we compare the "worried about money" with "PMK has a college or university degree" (relative to the base secondary education or less) in the OLS model (see Table 2.4 Columns 1 and 5). A 1-point increase in being worried about money (using the continuous measure) increases the inattentive/hyperactive behaviour score by 0.20 for gilrs and 0.16 for boys, while PMK having a university education decreases hyperactivity by 0.17. and 0.24 for boys. If we think that mother education is a key correlate of child behaviour, this suggests that parental economic insecurity has comparable effects in children: a 1-point increase in "worry about money" on a 4-point scale could offset the effects of mother's university education in children's upbringing.

2.5.2 Emotion/Anxiety Score

Table 2.5 reports both the OLS and fixed effects estimates for the emotion/ anxiety score. First, the continuous "worry about money" variable is significant and positive for both genders (see Table 2.5 Columns 1 and 5). A 1-point increase in parental economic insecurity is associated with a 0.14-point increase in anxiety for girls, and a 0.08-point increase for boys, which is equivalent to a 9% of standard deviation increases for girls, and a 5% standard deviation increase for boys. Specification 2 reports the estimates using categorical measures of worry about money (see Columns 2 and 6). Comparing to "disagree with worry about money", "strongly worry about money" increases anxiety level by 0.19 point in girls and 0.23 point in boys, or 12% and 14% increase in standard deviation respectively.

Each level of worry about money for girls are significant at a 1% level, with a negative effect associated with "Worry about money: strongly disagree" and a positive effect associated with "Worry about money: strongly agree". The difference in girls' anxiety scores between the highest and lowest level of economic insecurity is 0.34 point (i.e. 21% standard deviation).

In the fixed effect estimations, "worry about money" is significantly associated with a higher anxiety level for girls, though not for boys. For the continuous specification, a 1-point increase in "worry about money" increases girls' anxiety score by 0.055 point on average. In the categorical specification, "strongly worry about money" increases anxiety score by 0.15 point in girls, compare to the base "worry about money: disagree". It indicates a 10% standard deviation increase in girls' anxiety score.[1]

Again, to put the magnitude of the economic insecurity estimate in context, we compare it with the size of the divorce coefficient captured by the lone-parent variable in the fixed effects model (see Table 2.5 Column 3 and 4). Compared to an always-married family, a child whose parents divorce between the ages of 2/3 and 4/5 has an anxiety level that is 0.30 points higher. Changing from "Worry about money: disagree" to "Worry about money: strongly agree" is associated with an increase in the emotion/anxiety scale of 0.15 point. In other words, if economic insecurity changes from 2 to 4, the detrimental effect on girls' anxiety is 50% of the effect associated with divorce.[2]

[1]The fixed effects estimates show that income increases children's anxiety score. It is possible that income increases parents' anticipation towards children which result in higher anxiety in children. It is also possible that the negative association with income is picking up the longer working hours necessary for parents to earn higher incomes and one implication of greater working time - parents spending less time with children. The latter hypothesis is supported by the negative coefficient of income in the estimation of the positive interaction parenting score (see Section 2.6).

[2]For both hyperactivity and anxiety scores, we test that the gender differences are significant by pooling boys and girls together and include gender interaction with "worry about money". The estimates show that parental economic insecurity affects boys' hyperactivity score more than girls', and girls' anxiety score more than boys'.

2.6 Possible channels from parental economic insecurity to child outcomes

From the previous section, we observe a negative relationship between children's non-cognitive skills and parental economic insecurity. The question subsequently arises: why are children affected by parental economic insecurity? We propose that two channels affect children: a direct channel and an indirect channel. The direct channel is emotional mirroring, which is the subconscious imitation of another person's emotion (Chartrand & Bargh, 1999). Young children learn to behave and feel by mimicry of the parents. If parents are tense, then children will mirror the tenseness. The indirect channel is through poor parenting behaviours associated with economic stress. Exposure to stress hormones can change brain structure, affecting cognition (Lupian et al, 2009). Parents under economic stress are more likely to make poor parenting decisions.

Since the direct channel is not directly measurable, we examine parenting behaviours. The NLSCY provides various parenting style indices designed by Dr. M. Boyle at McMaster University and Dr. Ken Dodge at Vanderbilt University, including ineffective parenting, irrational parenting, consistent parenting and positive interaction. We use positive interaction and consistent parenting to represent "positive" parenting behaviours, and we employ ineffective parenting and irrational parenting to be proxies for "negative" parenting.

Each of the four parenting indicators is derived using a set of questions (detailed question composition of the indices can be found in Appendix 1). The consistent parenting style is constructed from questions about whether PMKs enforce rules, and if the child can get out of punishment. A high score indicates more consistent parenting. The positive interaction score is derived from questions such as if PMK praises the child, laughs with them and plays games with the child. The ineffective parenting score uses questions about if PMKs have difficulty managing their children, get annoyed and angry with their children. The irrational parenting style score is from questions such as if the PMK yells at the child or uses physical punishment. High values of the first two parenting scores, and low values of the last two parenting scores represent "positive" parenting.

To estimate the effects of economic insecurity on parenting styles, we substitute

the dependent variables in Equations 2.1 ad 2.2 for the parenting indicators. Table 2.6 reports the estimates of the association between parent reports of worrying about money and the "positive" parenting index. The continuous measure of "Worry about money" is significant and negative for both positive interaction score and consistent parenting score in the OLS estimation, meaning economic insecurity reduces the level of "positive" parenting. Specification 2 reports categorical measure of "worry about money". It shows that as parents are less worried about money, they spend more times in positively interacting with their children and using more consistent parenting styles. The fixed effects estimation also indicates a negative association between consistent parenting score for girls and parental economic insecurity after controlling for the unobservables.

Table 2.7 shows the regressions for "negative" parenting style. The continuous measure of parental economic insecurity (1 to 4) is significant and positive in all OLS and FE regressions indicating positive association between "worry about money" and both the inefficient parenting score and irrational parenting scores". In specification 2, "worry about money: strongly agree" is associated with high scores of both inefficient parenting and irrational parenting. "Worry about money: strongly disagree" is correlated with low scores of both negative parenting indicators. It demonstrates that "negative" parenting strategies are more frequently adopted when a higher level of economic insecurity is present (e.g., a parent may yell more when stressed about money). If we compare the effects on "positive" with "negative" parenting indicators, parental economic insecurity increases "negative" parenting more than it decreases "positive" parenting.

Those results strongly indicate that when parents worry about money, they spend less time with their children, and are less able to enforce the rules. They are also more likely to be angry with their children, and to use physical punishment. Thus, we regard it as plausible that parental economic insecurity influences children at least in part through parenting behaviours.

2.7 Further results

One of the most important events that could affect children's outcomes is divorce. In the main estimation, we include both lone-parent families and married families. There are three potential explanations: 1) Economic insecurity causes family dissolution and thus affecting child outcomes; 2) Family dissolution affects both economic insecurity and child outcomes; 3) Economic insecurity directly affects child outcomes. Therefore, to remove the confounding effects from divorce, we re-estimate Equations 2.1 and 2.2 in two samples: 1) children in lone-parent families (14% of the full sample) and 2) children whose parents are always married (84% of the original sample).

Table 2.8 shows the estimates of hyperactivity and anxiety using lone-parent only. The estimates indicate that economic insecurity remains statistically significant for girls in the OLS estimation, but not in the fixed effects estimation. The effects on boys' hyperactivity becomes insignificant for lone-parent families. "Worry about money" measures are significant on emotional disorder/anxiety scores, especially in fixed effects estimation for girls and the OLS estimation for boys. The anxiety score increases more significantly with "worry about money" for both continuous measure and the categorical measure than the full sample estimates.

Table 2.9 shows the estimates of hyperactivity and anxiety scores using always-married families only. Compared to the full sample estimation, girls' hyperactivity estimates are similar to the full sample estimation, while boys' hyperactivity estimates are more significant than the full sample estimation. The anxiety scores for both genders are not significantly different from the full sample estimation.

The results indicate that girls in lone-parent families are more likely to be anxious, and boys in always-married families are more likely to be hyperactive than the population average. It means that without the changes in parents' marital status, the economic insecurity still increases girls' anxiety and boys' hyperactivity. Thus, it is plausible to draw the conclusion that parental economic insecurity hinders the development of children's non-cognitive skills.

2.8 Conclusion

This paper studies connections between parental economic insecurity and outcomes for 2 to 5 year-old Canadian children. Results for both OLS and fixed effects models suggest that inattentive/hyperactive behaviours and emotional/anxious behaviours are positively associated with parents being 'worried about having enough money to meet family needs.' We illustrate that a plausible channel from parental economic insecurity to children's outcomes is through the parenting behaviours. Less "positive" and more "negative" parenting strategies are reported when parents experience economic insecurity.

Future research can focus on attempting to quantify the "direct" and "indirect" channel of parental economic insecurity on children. A cross-country comparison between the United States and Canada using National Longitudinal Survey of Youth may allow for more variation in policy, which may improve/worsen economic security for parents.

Table 2.1: Distribution of "You worry about whether the money you have will be enough to support your family?" Answered by PMKs of girls and boys at age 2 to 5. Year 2000 to 2008.

Worry about money	Distribution
Strongly disagree	0.17
Disagree	0.36
Agree	0.33
Strongly agree	0.15
Total	1

Source: NLSCY, pooled cross-sections.

Table 2.2: Summary statistics

VARIABLES	(1) N	(2) Mean	(3) Std. Dev.
Hyperactivity (0-12)	39711	3.54	2.38
Anxiety (0-12)	39711	1.44	1.59
Worry about money (1-4)	39711	2.46	0.94
Positive interaction (0-20)	39448	15.87	2.50
Ineffective parenting (0-28)	38803	8.61	3.36
Consistent parenting (0-20)	38227	15.32	3.12
Irrational parenting (0-16)	39301	4.56	2.41
Total HH income (2008$)	39711	81395	64408
Log equiv income	39711	10.39	0.66
Household size	39711	4.21	1.21
Number of children	39711	2.18	0.98
Boy	39711	0.51	0.50
Child age	39711	3.52	1.12
PMK is immigrant	39711	0.16	0.37
PMK health (1-4)	39711	3.05	0.89
Child health (1-4)	39711	3.53	0.70
PMK <secondary edu	39279	0.11	0.31
PMK secondary	39279	0.19	0.39
PMK some post-secondary	39279	0.14	0.35
PMK college or university	39279	0.56	0.50
Not in school/daycare	39711	0.27	0.44
Daycare	39711	0.55	0.50
Junior kindergarten	39711	0.07	0.25
Primary (NS)	39711	0.11	0.31
Grade 1	39711	0.00	0.03
Male PMK	39711	0.07	0.26
First-born	39711	0.44	0.50
PMK always married/common-law	39711	0.84	0.36
Two-parent family	39711	0.86	0.34
Lone-parent family	39711	0.14	0.34
Lone mother	39711	0.13	0.34
Step-family	39711	0.02	0.14
PMK is bio-mother	39711	0.92	0.27
PMK is bio-father	39711	0.07	0.25
PMK is either bio father or mother	39711	0.01	0.09
Rural	39711	0.12	0.32
Year 2000	39711	0.09	0.29
Year 2002	39711	0.26	0.44
Year 2004	39711	0.26	0.44
Year 2006	39711	0.16	0.37
Year 2008	39711	0.22	0.41

Source: NLSCY. Sample of analysis.

Table 2.3: Mean inattention/hyperactivity and emotion/anxiety scores for 2 to 5 year-old Canadian children, by level of parental economic insecurity, year 2000 to 2008.

Outcome	Hyperactivity				Anxiety			
	Mean	Std. Err	[95% Conf.	Interval]	Mean	Std. Err	[95% Conf.	Interval]
Not at all worry about money	3.23	0.05	3.13	3.33	1.32	0.03	1.26	1.38
Not worry about money	3.39	0.03	3.33	3.46	1.36	0.02	1.32	1.41
Worry about money	3.70	0.04	3.63	3.78	1.52	0.03	1.47	1.57
Strongly worry about money	3.86	0.05	3.75	3.96	1.58	0.04	1.50	1.65

Source: NLSCY

Table 2.4: OLS and fixed effect estimates of inattentive/hyperactivity score. Children from age 2 to 5. Year 2000 to 2008.

	Girl				Boy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	OLS	OLS	FE	FE	OLS	OLS	FE	FE
Worry about money (1-4)	0.201***		0.0450		0.160***		0.0623*	
	(0.0335)		(0.0317)		(0.0346)		(0.0326)	
Worry about money=4		0.308***		0.102		0.396***		0.153*
		(0.0929)		(0.0833)		(0.0928)		(0.0858)
Worry about money=3		0.311***		0.0728		0.258***		0.119*
		(0.0711)		(0.0613)		(0.0740)		(0.0612)
Worry about money=1		-0.210***		-0.0163		-0.0163		0.00275
		(0.0791)		(0.0699)		(0.0889)		(0.0709)
PMK has a college or university degree	-0.166**	-0.162**			-0.241***	-0.242***		
	(0.0656)	(0.0653)			(0.0682)	(0.0681)		
Observations	19,200	19,200	19,408	19,408	20,079	20,079	20,303	20,303
R-squared	0.054	0.055	0.005	0.005	0.049	0.050	0.003	0.003
Time-variant controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-invariant controls	Yes	Yes	No	No	Yes	Yes	No	No
Number of persruk			13,245	13,245			13,923	13,923

Source: NLSCY. Standard errors clustered at the household level. *** p<0.01, ** p<0.05, * p<0.1.

Note: "Worry about money=1" indicates "Worry about money: strongly disagree", and "Worry about money=4' indicates "Worry about money: strongly agree". Time-variant controls include log equivalent income, child's health, PMK's health, lone-parent, and step-family. Time-invariant controls include child age, first-born, child schooling, number of children, PMK and child relationship, PMK's health, PMK is an immigrant, PMK's education, rural, province of residence and survey year.

Table 2.5: OLS and fixed effect estimates of emotion/anxiety score. Children from age 2 to 5. Year 2000 to 2008.

	Girl				Boy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	OLS	OLS	FE	FE	OLS	OLS	FE	FE
Worry about money (1-4)	0.138***		0.0554**		0.0804***		-0.00411	
	(0.0236)		(0.0230)		(0.0221)		(0.0237)	
Worry about money=4		0.193***		0.153**		0.232***		-0.0544
		(0.0667)		(0.0629)		(0.0632)		(0.0614)
Worry about money=3		0.231***		0.0595		0.105**		0.0460
		(0.0519)		(0.0440)		(0.0447)		(0.0429)
Worry about money=1		-0.148***		-0.0124		0.00828		-0.0112
		(0.0517)		(0.0498)		(0.0548)		(0.0537)
Lone-parent family	0.0226	0.0373	0.298***	0.297***	0.0800	0.0709	0.422***	0.430***
	(0.0781)	(0.0779)	(0.111)	(0.111)	(0.0718)	(0.0722)	(0.110)	(0.110)
Observations	19,200	19,200	19,408	19,408	20,079	20,079	20,303	20,303
R-squared	0.050	0.051	0.012	0.012	0.047	0.047	0.017	0.017
Time-variant controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-invariant controls	Yes	Yes	No	No	Yes	Yes	No	No
Number of persruk			13,245	13,245			13,923	13,923

Source: NLSCY. Standard errors clustered at the household level. *** p<0.01, ** p<0.05, * p<0.1.

Note: "Worry about money=1" indicates "Worry about money: strongly disagree", and "Worry about money=4' indicates "Worry about money: strongly agree". Time-variant controls include log equivalent income, child's health, PMK's health, lone-parent, and step-family. Time-invariant controls include child age, first-born, child schooling, number of children, PMK and child relationship, PMK's health, PMK is an immigrant, PMK's education, rural, province of residence and survey year.

Table 2.6: OLS and fixed effect estimates of positive interaction and consistent parenting. Children from age 2 to 5. Year 2000 to 2008.

	Positive Interaction							
	Girl				Boy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	OLS	OLS	FE	FE	OLS	OLS	FE	FE
Worry about money (1-4)	-0.0973***		-0.00497		-0.0974***		0.00445	
	(0.0361)		(0.0386)		(0.0338)		(0.0375)	
Worry about money=4		-0.0499		0.0316		-0.0723		0.0127
		(0.109)		(0.103)		(0.0917)		(0.100)
Worry about money=3		-0.135*		-0.0760		-0.113		-0.0152
		(0.0720)		(0.0729)		(0.0704)		(0.0704)
Worry about money=1		0.209***		0.00138		0.209**		-0.0130
		(0.0797)		(0.0918)		(0.0843)		(0.0824)
PMK has college or university degree	0.0741	0.0694			0.244***	0.239***		
	(0.0662)	(0.0661)			(0.0662)	(0.0662)		
Lone-parent family	0.0215	0.000179	-1.311***	-1.317***	-0.0205	-0.0372	-1.333***	-1.334***
	(0.108)	(0.109)	(0.161)	(0.161)	(0.111)	(0.111)	(0.164)	(0.164)
Observations	19,092	19,092	19,298	19,298	19,928	19,928	20,150	20,150
R-squared	0.187	0.188	0.053	0.053	0.189	0.190	0.055	0.055
Time-variant controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-invariant controls	Yes	Yes	No	No	Yes	Yes	No	No
Number of persruk			13,174	13,174			13,835	13,835
	Consistent Parenting							
	Girl				Boy			
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
VARIABLES	OLS	OLS	FE	FE	OLS	OLS	FE	FE
Worry about money (1-4)	-0.250***		-0.111**		-0.0805*		-0.0108	
	(0.0497)		(0.0438)		(0.0438)		(0.0429)	
Worry about money=4		-0.458***		-0.204*		-0.0798		0.0578
		(0.147)		(0.120)		(0.126)		(0.113)
Worry about money=3		-0.275***		-0.115		-0.183**		-0.0401
		(0.0931)		(0.0826)		(0.0917)		(0.0802)
Worry about money=1		0.273**		0.125		0.0875		0.0731
		(0.107)		(0.0944)		(0.104)		(0.0917)
PMK has college or university degree	0.415***	0.413***			0.457***	0.454***		
	(0.0928)	(0.0925)			(0.0830)	(0.0832)		
Lone-parent family	-0.00565	-0.0122	0.651***	0.650***	0.0380	0.0241	0.267	0.256
	(0.154)	(0.155)	(0.212)	(0.212)	(0.159)	(0.161)	(0.201)	(0.202)
Observations	18,463	18,463	18,666	18,666	19,346	19,346	19,561	19,561
R-squared	0.095	0.095	0.006	0.006	0.089	0.090	0.006	0.006
Time-variant controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-invariant controls	Yes	Yes	No	No	Yes	Yes	No	No
Number of persruk			12,904	12,904			13,548	13,548

Source: NLSCY. Standard errors clustered at the household level. *** p<0.01, ** p<0.05, * p<0.1.

Note: "Worry about money=1" indicates "Worry about money: strongly disagree", and "Worry about money=4' indicates "Worry about money: strongly agree". Time-variant controls include log equivalent income, child's health, PMK's health, lone-parent, and step-family. Time-invariant controls include child age, first-born, child schooling, number of children, PMK and child relationship, PMK's health, PMK is an immigrant, PMK's education, rural, province of residence and survey year.

Table 2.7: OLS and fixed effect estimates of ineffective parenting and irrational parenting. Children from age 2 to 5. Year 2000 to 2008.

	Inefficient Parenting							
	Girl				Boy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	OLS	OLS	FE	FE	OLS	OLS	FE	FE
Worry about money (1-4)	0.359***		0.207***		0.352***		0.0970**	
	(0.0511)		(0.0468)		(0.0490)		(0.0469)	
Worry about money=4		0.603***		0.444***		0.653***		0.0795
		(0.144)		(0.128)		(0.140)		(0.128)
Worry about money=3		0.579***		0.229***		0.448***		0.0443
		(0.106)		(0.0887)		(0.103)		(0.0870)
Worry about money=1		-0.306**		-0.163		-0.333***		-0.245**
		(0.121)		(0.102)		(0.115)		(0.0977)
PMK has college or university degree	0.240**	0.247**			0.0634	0.0661		
	(0.0983)	(0.0979)			(0.0944)	(0.0943)		
Lone-parent family	-0.0456	-0.0218	-0.534**	-0.534**	-0.270*	-0.262	-0.196	-0.181
	(0.156)	(0.157)	(0.237)	(0.237)	(0.159)	(0.159)	(0.218)	(0.218)
Observations	18,768	18,768	18,971	18,971	19,615	19,615	19,832	19,832
R-squared	0.041	0.043	0.010	0.010	0.033	0.033	0.005	0.006
Time-variant controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-invariant controls	Yes	Yes	No	No	Yes	Yes	No	No
Number of persruk			13,028	13,028			13,680	13,680
	Irrational Parenting							
	Girl				Boy			
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
VARIABLES	OLS	OLS	FE	FE	OLS	OLS	FE	FE
Worry about money (1-4)	0.133***		0.176***		0.180***		0.147***	
	(0.0299)		(0.0466)		(0.0303)		(0.0461)	
Worry about money=4		0.157*		0.189		0.293***		0.113
		(0.0852)		(0.125)		(0.0827)		(0.122)
Worry about money=3		0.229***		0.0849		0.183***		0.151*
		(0.0652)		(0.0862)		(0.0604)		(0.0860)
Worry about money=1		-0.166**		-0.389***		-0.247***		-0.326***
		(0.0741)		(0.0986)		(0.0711)		(0.101)
PMK has college or university degree	-0.0737	-0.0692			-0.105*	-0.103*		
	(0.0618)	(0.0617)			(0.0562)	(0.0562)		
Lone-parent family	-0.177*	-0.158	-1.415***	-1.414***	-0.185**	-0.175*	-1.247***	-1.224***
	(0.101)	(0.102)	(0.193)	(0.192)	(0.0935)	(0.0935)	(0.198)	(0.198)
Observations	19,006	19,006	19,213	19,213	19,866	19,866	20,088	20,088
R-squared	0.305	0.305	0.035	0.036	0.306	0.306	0.038	0.039
Time-variant controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-invariant controls	Yes	Yes	No	No	Yes	Yes	No	No
Number of persruk			13,136	13,136			13,808	13,808

Source: NLSCY. Standard errors clustered at the household level. *** p<0.01, ** p<0.05, * p<0.1.

Note: "Worry about money=1" indicates "Worry about money: strongly disagree", and "Worry about money=4' indicates "Worry about money: strongly agree". Time-variant controls include log equivalent income, child's health, PMK's health, lone-parent, and step-family. Time-invariant controls include child age, first-born, child schooling, number of children, PMK and child relationship, PMK's health, PMK is an immigrant, PMK's education, rural, province of residence and survey year.

Table 2.8: OLS and fixed effect estimates of hyperactivity and anxiety scores. Children from age 2 to 5 in lone-parent families. Year 2000 to 2008.

	Hyperactivity							
	Girl				Boy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	OLS	OLS	FE	FE	OLS	OLS	FE	FE
Worry about money (1-4)	0.221***		0.0588		0.0994		0.117	
	(0.0829)		(0.0938)		(0.0982)		(0.102)	
Worry about money=4		0.392*		0.126		0.263		0.217
		(0.208)		(0.220)		(0.215)		(0.243)
Worry about money=3		0.256		0.138		0.0395		0.0862
		(0.201)		(0.202)		(0.202)		(0.211)
Worry about money=1		-0.335		-0.0450		0.0569		-0.162
		(0.314)		(0.331)		(0.355)		(0.358)
Observations	2,814	2,814	2,843	2,843	2,858	2,858	2,892	2,892
R-squared	0.114	0.115	0.018	0.018	0.084	0.085	0.015	0.015
Time-variant controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-invariant controls	Yes	Yes	No	No	Yes	Yes	No	No
Number of persruk			2,221	2,221			2,248	2,248
	Anxiety							
	Girl				Boy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	OLS	OLS	FE	FE	OLS	OLS	FE	FE
Worry about money (1-4)	0.1000*		0.150**		0.139**		-0.0513	
	(0.0580)		(0.0622)		(0.0625)		(0.0891)	
Worry about money=4		0.0784		0.280*		0.285**		-0.105
		(0.152)		(0.151)		(0.134)		(0.192)
Worry about money=3		0.150		0.0791		0.157		0.0353
		(0.126)		(0.142)		(0.117)		(0.167)
Worry about money=1		-0.390**		-0.192		-0.116		0.0298
		(0.175)		(0.202)		(0.221)		(0.289)
Observations	2,814	2,814	2,843	2,843	2,858	2,858	2,892	2,892
R-squared	0.109	0.112	0.017	0.018	0.109	0.109	0.032	0.033
Time-variant controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-invariant controls	Yes	Yes	No	No	Yes	Yes	No	No
Number of persruk			2,221	2,221			2,248	2,248

Source: NLSCY. Standard errors clustered at the household level. *** p<0.01, ** p<0.05, * p<0.1.

Note: "Worry about money=1" indicates "Worry about money: strongly disagree", and "Worry about money=4' indicates "Worry about money: strongly agree". Time-variant controls include log equivalent income, child's health, PMK's health, lone-parent, and step-family. Time-invariant controls include child age, first-born, child schooling, number of children, PMK and child relationship, PMK's health, PMK is an immigrant, PMK's education, rural, province of residence and survey year.

Table 2.9: OLS and fixed effect estimates of hyperactivity and anxiety scores. Children from age 2 to 5 with married parents. Year 2000 to 2008.

	Hyperactivity							
	Girl				Boy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	OLS	OLS	FE	FE	OLS	OLS	FE	FE
Worry about money (1-4)	0.211***		0.0492		0.163***		0.0503	
	(0.0364)		(0.0350)		(0.0375)		(0.0356)	
Worry about money=4		0.306***		0.144		0.424***		0.173*
		(0.106)		(0.0953)		(0.105)		(0.0980)
Worry about money=3		0.337***		0.0635		0.275***		0.0864
		(0.0762)		(0.0669)		(0.0797)		(0.0663)
Worry about money=1		-0.206**		-0.00243		0.00584		0.0348
		(0.0813)		(0.0738)		(0.0928)		(0.0729)
Observations	16,104	16,104	16,278	16,278	16,920	16,920	17,107	17,107
R-squared	0.045	0.046	0.003	0.003	0.044	0.045	0.003	0.003
Time-variant controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-invariant controls	Yes	Yes	No	No	Yes	Yes	No	No
Number of persruk			11,118	11,118			11,731	11,731
	Anxiety							
	Girl				Boy			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	OLS	OLS	FE	FE	OLS	OLS	FE	FE
Worry about money (1-4)	0.140***		0.0490*		0.0755***		-0.00276	
	(0.0255)		(0.0253)		(0.0237)		(0.0250)	
Worry about money=4		0.195***		0.161**		0.243***		-0.0611
		(0.0745)		(0.0724)		(0.0718)		(0.0684)
Worry about money=3		0.243***		0.0590		0.0974**		0.0296
		(0.0561)		(0.0483)		(0.0486)		(0.0454)
Worry about money=1		-0.127**		0.00896		0.0205		-0.0215
		(0.0537)		(0.0525)		(0.0568)		(0.0553)
Observations	16,104	16,104	16,278	16,278	16,920	16,920	17,107	17,107
R-squared	0.045	0.046	0.013	0.014	0.043	0.044	0.015	0.015
Time-variant controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time-invariant controls	Yes	Yes	No	No	Yes	Yes	No	No
Number of persruk			11,118	11,118			11,731	11,731

Source: NLSCY. Standard errors clustered at the household level. *** p<0.01, ** p<0.05, * p<0.1.

Note: "Worry about money=1" indicates "Worry about money: strongly disagree", and "Worry about money=4' indicates "Worry about money: strongly agree". Time-variant controls include log equivalent income, child's health, PMK's health, lone-parent, and step-family. Time-invariant controls include child age, first-born, child schooling, number of children, PMK and child relationship, PMK's health, PMK is an immigrant, PMK's education, rural, province of residence and survey year.

Chapter 3

Fatter Kids and the Shattered "Iron Rice Bowl": Intergenerational Effects of Economic Insecurity During Chinese State-Owned Enterprise Reform

3.1 Introduction

Economic insecurity, or the perception of "a significant and unavoidable downside economic risk" in the future (Osberg, 1998 and 2015a), is an expectation of future economic losses which results from past and present experiences. It is not only a leading cause of family dissolution (Larson et al., 1994), but also contributes to deterioration of health (Tsutsumi et al., 2001; Rohde et al., 2016; Watson, Osberg & Phipps, 2016; Rohde, Tang & Osberg, 2017).

Blanchflower and Oswald (1999), Clark and Grey (1997), Hacker et al. (2010) have argued that economic insecurity has been on a gradual rise since the 1970s in countries all around the world, but in few cases has economic insecurity surged as dramatically and influentially as in China during the late 1990s. Because of state-owned enterprise (SOE) reform, 34 million workers from the state sector were laid off between 1995 and 2001, thereby heightening the insecurity of the 51 million continuing SOE employees. The magnitude and speed of these changes occurred at historically unprecedented rates.

Layoffs from state-owned enterprise reform were particularly harsh on state sector workers because: (1) the state sector in China had never witnessed employment uncertainty before this layoff policy, making the workers especially unprepared. Therefore, the job losses were unanticipated and involuntary; (2) the social safety net was under-developed in China. Little social assistance or job-search assistance was provided to the laid-off workers; (3) laid-off workers were mostly older, unskilled, and female, which added to the challenges of re-employment. These disadvantages made the economic insecurity to which they were subjected particularly

significant.

One of the most common outcomes for health is body mass indicator (BMI). Among other causes, it has been well-established that greater economic insecurity increases weight gain in adults (Smith 2009; Watson et al., 2016; and Rohde et al., 2016). The innovation of this study is to examine the intergenerational effects of such insecurity and the effects of greater parental economic insecurity in a developing country (China) on children and adolescents.

Cole et.al. (2000) document that the prevalence of obesity has increased dramatically in developed countries. In developing countries, malnutrition and infectious diseases are declining, while obesity, cardiovascular diseases, and Type 2 diabetes are rising (WHO, 2000). In 2011, 30% of Chinese adults and 11% of Chinese children were overweight (Yan et al., 2012).

Child obesity not only leads to adult obesity (Abraham et al., 1971; Guo et al., 1994; Sorensen & Sonne-Holm, 1988) but also chronic diseases, such as impaired glucose metabolism, hypertension, coronary arteries (Kavey, et al., 2003). Child obesity is particularly linked to the development of Type 2 diabetes at a younger age (WHO 2000) and can also adversely influence psychological wellbeing later in life (Friedman and Brownell, 1995)

To account for rates of maturation and growth, I use the most prominent references including the World Health Organization (WHO) growth standard, and the United States Centers for Disease Control and Prevention (CDC) standards to adjust BMI and weight for age and gender specific measures. I also include the waist-to-height ratio to complement BMI measures following suggestions in the medical literature (Mokha et al., 2010; Schneider et al., 2010; Yan et al. 2007; and Burkhauser & Cawley, 2008). The waist-to-height ratio distinguishes body fat from bones and muscles, and differentiates abdominal fat from skin fat. Yan et al. (2007) note the racial neutrality of the waist-to-height ratio and that it is an accurate measure for Chinese children.

I estimate the effects on the BMI measures and waist-to-height ratio using the expected economic loss at Chinese provincial- and year-levels (i.e., treatment with different intensities). A continuous difference-in-difference model compares the layoff effects in the state sector (treatment group by changes in layoff policy) and the

non-state sector (control group, not directly affected by changes in the state sector layoff policy). The results show a significantly greater weight gain in boys whose parents work in the state sector when the expected economic loss is high. The results persist for boys of parents working in the state sector even if neither parent actually experienced a layoff. It suggests that anxiety about the future (i.e., economic insecurity) is at least a major reason for weight gain in children. I examine the differential impacts of economic insecurity – the probability of job loss and financial loss of layoff. The probability of job loss has more significant negative effects on child weight gain than the severity of financial loss of layoff.

The non-constant effects of parental economic insecurity on children's weight gains are examined using quantile regressions. The rational is to test if parental insecurity has larger impacts on children's weight gain for those who are already overweight, versus making children who are underweight and become normal weight. The results suggest more severe effects of weight gain in heavier children caused by parental economic insecurity. This means the threat posed by weight gain in children is greater because the weight gain is more significant in children above normal weight.

3.2 China State-Owned Enterprise Reform

During Mao Zedong's era, China was a planned economy. Jobs were assigned according to quotas decided by government and job candidates had little freedom to choose their employment. Lifelong employment of urban workers was provided by the government with benefits that include child care, health care, housing and pensions (Lee, 2000). State sector employment, therefore, was considered an "iron rice bowl", with no economic insecurity.

Inefficiency in resource allocation and the lack of work incentives shattered the "iron rice bowl" (Lin, Cai & Li, 1998). In 1995, China enacted a new labour law that allowed the dismissal of no-fault workers. A new word, *Xia Gang* (Layoff), was thus invoked and used in the China Labour Statistics Yearbook. In 1997, layoffs were further intensified by extending the new labour law to large-scale state-owned enterprises. From 1995 to 2001, state-owned sector employment dropped from 113 million to 67 million, a 40% decrease. According to the China Urban

Labour Survey, these layoffs caused the unemployment rate to surge to more than 10%, and labour force participation to decline by up to 8.9% in representative cities. The state-owned enterprise reform introduced employment uncertainty for the first time since the establishment of the Communist Government in 1949 (Giles, Park & Cai, 2006).

3.2.1 Social support

Living subsidies for laid-off workers were initially provided by the original employers (i.e., the state-owned enterprises). In the late 1990s, protection against job loss gradually shifted to unemployment insurance. In general, social insurance programs in China in the late 1990s were severely underdeveloped; hence provided little protection against unexpected job loss. Unemployment insurance (UI) system was introduced in China in 1986. Benefit levels were set by the local government at a range between minimum living standards (Dibao) and the minimum wage rate. Compared to developed countries, UI in China provides a much lower income replacement rate. For example, in 2005, the UI benefits paid as a percentage of average urban on-work wages was only 14.7% (Giles, Park & Cai, 2006).

The duration of benefits depends on the UI contributions, and may last up to 24 months. To qualify for UI, workers must meet the following conditions: 1) have contributed to UI for at least a year; 2) are terminated involuntarily, 3) are willing to work. By the early 2000s, it only covered 40% of urban workers (Giles, Park & Cai, 2006). With the low coverage and low replacement rate, laid-off workers had to rely on personal savings and private support from relatives. The structural change in the economy increased the difficulties for laid-off workers to find new jobs without the support of adequate job training program. The re-employment rate of the laid-off workers from the state sector was only 29.1% after one year, and 36.9% after five years (Giles, Park & Cai, 2006).

The remaining state employees were also affected by the reform, experiencing wage and pension arrears and benefits reductions including decreased health insurance coverage and housing benefits. These on-job economic losses along with the now greater potential for outright job loss meant a significant increase in anxiety and economic insecurity for continuing state workers. In other words, the impact of the

new layoff policy was not limited to those actually laid-off in the state sector.

3.3 Mechanism of Health Effects of Economic Insecurity

3.3.1 Overeating and Economic Insecurity

The causal relationship between adult weight gain and economic insecurity has recently been established in economic literature. Offer et al. (2010) use macro-level data from 11 developed countries over ten years and suggest the obesity epidemic is mainly contributed by social insecurity. Where socioeconomic supports do not provide much protection against economic losses, people tend to respond more to fast food "shock" because of the economic stress. When the possibility of economic loss is well-insured by social programs, even though there is abundant calorie rich food, people tend to not overeat and obesity prevalence is significantly lower. Smith, Stoddard and Barnes (2009) use 12 years panel data from the United States National Longitudinal Survey of Youth, and find that a one-percentage-point rise in the probability of becoming unemployed increases adult weight gain by 0.6 pounds, and the social safety net decreases the negative effect of economic insecurity. Using the Canadian Community Health Survey data, Watson, Osberg and Phipps (2016) exploit the unemployment insurance benefit cuts in the 1990s as an exogenous "natural experiment" variation in economic insecurity, and establish the causal relationship between economic insecurity and the BMI gain in adults. Rohde, Tang and Osberg (2017) use the Household, Income and Labour Dynamics in Australia (HILDA) Survey and find that the economic insecurity and adult obesity form a self-sustaining vicious cycle.

Literature in psychology and neuroscience has linked stress to overeating (Greeno and Wing, 1994). Stress induces people to turn to "comfort food" that is high in calorie and fat (Dallman et al., 2003). Smith (2009) suggests there is a biochemical mechanism of stress which can cause overeating. Like other animals, humans compensate for food uncertainty by overeating and storing body fat. The ability to store body fat is a survival instinct when the risk of starvation is present, and over-eating has been genetically "hard-wired" as a response to anxiety about future food availability. Although the risk of starvation is minimal for most contemporary

humans in affluent societies, stress and anxiety still come from economic uncertainties. In the presence of economic hazards, genes influence human behaviour and humans respond by overeating as a form of "self-medication" for stress—as the phrase "comfort foods" might suggest. In the Chinese context, it is worth noting that parents in the state sector have higher income than those in the non-state sector (see Table 3.3. Therefore, parents are economically able to purchase calorie rich food.

The innovation of this study is the intergenerational transmission mechanism. The possible channels include, inter alia: 1) economic insecurity increases precautionary savings of the family, thus reducing the monetary investment in the child. 2) Future uncertainty increases parents work hours to compensate for potential economic losses, thus reducing the time investment of the child and the positive interaction with the child. 3) Eating healthy takes time and energy. Economic insecurity generates mental stress for the parents. If a parent is stressed and make poor nutritious choices, it is difficult for the parent to deny the child from accessing the "junk food". 4) Under economic stress, parents are less likely to be able to enforce rules that keep their children eating healthy food. Other irrational parenting decisions may also occur as a result of economic anxiety.

3.3.2 Theoretical framework of intergenerational economic insecurity

I use three measures of economic insecurity: the probability of job loss, the financial loss from job loss, and expected economic loss from the fear of job loss. The three measures are defined as follow:

$$Prob(Layoff) = P \tag{3.1}$$

$$E(FinancialLoss) = E[\Delta Y|Layoff] = \Delta \tag{3.2}$$

$$E(EconomicLoss) = Prob(Layoff) \cdot E(FinancialLoss) = P \cdot \Delta \tag{3.3}$$

The economic insecurity at time t is based on the current and past experience:

$$Insecurity_t = f(P_{t-1}\Delta_{t-1}, P_t\Delta_t) \tag{3.4}$$

Heckman (2007) outlines how parental investment affects children's capabilities. These parental effects on children have focused mostly on positive investments, such as nutrition and care. In this chapter, I include the negative impact of parental economic insecurity on children's human capital formation, using Heckman (2007)'s model as the guideline. A child's capability production, θ at time t+1, is determined by the following factors: an initial endowment, θ_0 (e.g., genetic condition); parents' capabilities (e.g., parents' IQ, income, and education), h; parents' investment at period t, I_t. The level of investment is then determined by the economic insecurity at time t, $Insecurity_t$. The simplified production function for three periods of human capital formation is

$$\theta_{t+1} = f(h, \theta_0, I_t(Insecurity_t | P_{t-1}\Delta_{t-1}, P_t\Delta_t) \tag{3.5}$$

where $\frac{\partial \theta_{t+1}}{\partial I_t} > 0$,and $\frac{\partial I_t}{\partial Insecurity_t} < 0$. The first condition suggests that greater investment from parents promotes higher human capital formation of the child. The second condition assumes that a high degree of economic insecurity is associated with a low investment.

Three groups experience different changes in economic insecurity $P_t\Delta_t$. Group 1 is identified as the non-state sector, experiencing no change in expected layoff and financial loss from layoff, thus $\delta Insecurity = 0$. Group 2 can be the state sector in mildly affected province, where there is low expected economic loss, $\delta Insecurity = low$. Group 3 represents the state sector in the province that is affected severely by the layoff policy, and high economic loss is expected, $\delta Insecurity = high$.

The effect of parental economic insecurity on a child's outcome is denoted by $\alpha_1 = \frac{\partial \theta}{\partial Insecurity}$. The differential effect of the probability of job loss is captured by $\beta_1 = \frac{\partial \theta_{t+1}}{\partial P}$, and the severity of financial loss from layoff is $\beta_2 = \frac{\partial \theta_{t+1}}{\partial \delta}$. The empirical strategy to estimate α_1, β_1, and β_2 is explored in section 6.

3.4 Data

3.4.1 China Health and Nutrition Survey

This chapter uses data from the China Nutrition and Health Survey (CHNS) conducted by the University of North Carolina, Chapel Hill and the Chinese Center

for Disease Control and Prevention (CCDC). The CHNS is the only large-scale longitudinal household level survey in China (Popkin et al., 2010); it consists of 9 panels from 1989 to 2011 of more than 4000 households and 15,000 individuals. The data are collected at the community, household, and individual levels, and includes detailed information on economic, health, sociological, and demographic circumstances. Households are selected in both rural and urban areas in eight provinces: Liaoning, Shandong, Henan, Jiangsu, Hubei, Hunan, Guizhou, and Guangxi with multistage, random cluster design, stratified by income.

All household members are interviewed during the survey, and children younger than 10-years-old are assisted by their parents. One to six children in one family can be observed in the sample. On average, there are two children per family in the CHNS sample[1]. Special efforts are made to interview during the early morning or on weekends to avoid missing children who attend boarding school or migrant workers. The attrition rate at the household level is 10% from the previous cycle, and 31% from 1989 to 2006 (Popkin et al., 2010). Anthropometric measures, such as height and weight, are taken on site by the CHNS interviewers who had seven days of training by the collaborating teams. Children are measured without shoes and with light clothes to the nearest 0.1 cm and 0.1 kg respectively during the interview (Yan et al., 2012).

The CHNS has several features that make it particularly suitable for the study. First, the longitudinal structure provides a comparison of the outcomes of the same child before, during and after the state-owned enterprise reform period. Second, the large sample size enables analysis based on provincial heterogeneity as well as differences between state and non-state enterprises. Third, the CHNS has data not only on a single household member, but also on parents, spouses, and children based on the person-specific interviews, making it ideal for examining the spill-over effects of economic insecurity. Fourth, the CHNS interview questions cover not only labour market outcomes, such as employment status, sectors, and earnings of both parents, but also the health outcomes of the child, and other demographic characteristics of the family. The extensive and in-depth information enables the inclusion of almost all control variables used in the related literature.

[1]The one child policy does not generally apply in rural areas (Hesketh, Lu & Xing, 2005).

A supplementary dataset on layoffs is also used and comes from China Labour Statistics Yearbook produced by the National Bureau of Statistics of China. It reports the number of laid-off workers at year-end as well as the number of state-sector employees at the year-end by province from 1995 to 2005. These two variables allow estimates of the layoff rate across provinces and over time. It also reports the off-post (laid-off) state sector workers' living subsidies and the on-post (on the job) state-owned enterprise workers' average wage by province; from this the financial loss from layoff can be calculated.

3.4.2 Longitudinal Sample

The sample for this study is children and adolescents 4 to 18 years-old in every cycle who entered the survey in 1989, 1991 and 1993 (pre-reform cycles). The birth cohort of the sample is 1979 to 1993 and is observed in 1997, 2000, and 2004. There are 1,730 children and adolescents in the longitudinal sample and 2,636 observations in the pooled cross-sectional sample. Table 3.1 shows the number of same children observed in the panel in each year. Table 3.2 presents the age and year structure of the sample. Attrition comes mainly from the age limit of 18 years. Only "always married couples" are included for two reasons. First, the divorce rate during the survey period is extremely low (2%). Second, household dissolution itself can cause enormous mental and financial stress on family members, which would confound the estimated effects being examined. I also exclude families with negative income. The CHNS noted many households with negative net income from their business, especially those raising livestock. The nature of such businesses involves substantial initial investment, and the return may take years to happen. Therefore, the negative income does not necessarily reflect the economic condition of the family. Mothers who are above 60 years old and fathers above 70 years old are excluded from the sample (2 observations).

3.4.3 Definitions of Weight Measures

In this study, the two prominent international references for children's BMI measures are used. The first outcome variable in the study is the body mass index

(BMI) Z-score using the World Health Organization (WHO) child growth standards for 0 to 5 year-olds (World Health Organization, 2006) and WHO growth reference for 5 to 19 year-olds (Onis et al., 2007). The WHO growth standards collect data for healthy infants and young children from Brazil, Ghana, India, Norway, Oman and the United States, and the WHO growth references use the National Center for Health Statistics (NCHS) data, merged with a growth standard cross-sectional sample. Using the Box-Cox-power-exponential (BCPE) method and LMS methods (Cole and Green, 1992), the WHO constructs BMI for age, adjusting for skewness and kurtosis (see Figure 2 for growth charts). The BMI Z-score is calculated using the following equation.

$$BMIZ_{it} = \frac{BMI_{it} - \bar{BMI}_{WHO}}{\sigma_{BMI_{WHO}}} \tag{3.6}$$

where for child i in year t. The BMI Z-score measures how many standard deviations the child's BMI is from the gender and age specific median defined by WHO standards. Different from a unified BMI cutoff for all adults, the standard of BMI varies according to children's age and gender. According to the WHO standard, the median BMI is 15.2 for 5-year-old girls and 21.7 for 18-year-old-boys. By adopting the BMI Z-score, the outcome variable reflects the different standards at each growth stage of children. Observations that are over 5 standard deviations from the median are excluded in the sample according to WHO recommended outlier cutoffs.

The second variable is a weight-for-age Z-score using the United States Centers Disease Control 2000 Growth Reference with LMS method (Kuczmarski et al. 2000). The weight-for-age Z-score is generated in a similar manner to the BMI Z-score. It measures how many standard deviations the child's weight (in kg) is from the median of the age and gender specific group:

$$WFAZ_{it} = \frac{Weight_{it} - \bar{Weight}_{CDC}}{\sigma_{Weight_{CDC}}} \tag{3.7}$$

The mean of weight-for-age Z-score in the CHNS sample is -1.11. The state sector is -0.67, while the non-state sector is -1.18. The difference between the two sectors suggests that the state sector is the "better-off" group in the sample. Therefore,

weight gains in the state sector are less likely to imply children with malnutrition moving out of their underweight classification. Rather it suggests gaining weight by already well-fed children.

The first two outcome variables capture the different perspectives of weight gain with the leading international standards. Although BMI-related measures are frequently used in estimating the risk of obesity on morbidity risks, it has some major limitations. First, they do not distinguish fat from non-fat mass, such as muscle and bones, which would mistakenly classify an athlete with large muscle mass in the overweight category. Second, they do not inform the fat distribution in the body: If the fat is distributed in the abdominal area (i.e., if it is visceral fat) rather than underneath the skin (i.e., if it is subcutaneous fat), then it links to elevated cardiovascular risks (Schneider et al., 2010; Kuczmarski et al., 2000). Third, they are not specifically generated according to the Chinese population, nor are they adjusted for the recent trend of increase in child obesity. Negative health effects of obesity are found in the Asian population with a lower BMI (World Health Organization, 2000). Studies suggest that morbidity increases when BMI is greater than 23 in an Asian population (Ko et al., 1999; Deurenberg et al., 2002) instead of the cut-off of 25 used in adult Europids.

A growing medical literature (Mokha et al., 2010; Schneider et al., 2010; Yan et al. 2007; and Burkhauser & Cawley, 2008) argues that abdominal obesity is a more accurate indicator of health risks than BMI, and the waist-to-height ratio provides an accurate measure of evaluating child and adolescent obesity. In the normal weight group, children with central obesity (high waist circumference) are more likely to have adverse levels of LDL cholesterol, HDL cholesterol, triglycerides, and insulin; while children in overweight and obese groups without central obesity are less likely to have morbidity risks such as Type 2 diabetes mellitus, hypertension or metabolic syndrome than those with central obesity (Mokha et al., 2010)

To complement the other measures, I use waist-to-height ratio (WHtR) as the third outcome variable. It is defined as waist circumference divided by height, measured in the same unit. The advantages of the waist-to-height measure include its wide availability, accuracy and non-age- and race-dependency (Yan, 2007; Mokha, 2010). It not only provides information on body fat and fat distribution,

but also is comparable as it is age, gender, and race neutral. The kernel density distributions of the three outcome variables are presented in Figure 3. The distributions show a positive skewness, which corresponds to the previous literature that lower mean in the BMI is associated with Asian population (World Health Organization, 2000).

3.4.4 Economic insecurity and exogeneity of layoff policy

"Individuals feel economically insecure when they perceive a significant downside economic risk, which they are unable to adequately insure against or avoid or ignore" (Osberg, 1998 & 2015). In this study, change in expected economic loss in the state sector is the reason for greater economic insecurity, which can be thought about in three ways: first, the possibility of being laid off (layoff rate), where

$$LayoffRate_{pt} = \frac{Number\ of\ laid\text{-}off\ workers\ in\ state\ sector_{pt}}{Number\ of\ state\ sector\ workers_{pt}} \tag{3.8}$$

i.e., the layoff rate is measured by the number of laid off workers divided by the total number of state sector workers in the province p and year t; second, the financial loss if laid off:

$$FinancialLoss_{pt} = 1 - \frac{Average\ living\ subsidies\ of\ laid\text{-}off\ workers_{pt}}{Average\ wage\ rate\ of\ on\text{-}the\text{-}job\ workers\ in\ state\ sector_{pt}} \tag{3.9}$$

i.e., the average percentage income drop for laid-off workers in province p and year t; and third, the expected economic loss:

$$E(EconomicLoss)_{pt} = LayoffRate_{pt} \cdot FinancialLoss_{pt} \tag{3.10}$$

i.e., the product of probability of layoff and financial loss in the event of job loss in province p and year t.

The state sector reform has impacts of different intensity across province and year, which suggests that the measures of economic insecurity also vary by province and year. Figure 4 shows the map of sample provinces with expected economic loss peak years. Figure 5 presents the average layoff rate, of layoff in the state sector

by year and province. They demonstrate that the expected loss, probability of job loss (layoff rate), and the financial loss of laid-off workers vary across provinces and over time. For example, Liaoning in North Eastern China demonstrates a peak layoff rate of 16% and a financial loss of 84% after layoffs in 2000; this generates a 12% expected economic loss for all state-owned enterprise workers. Shandong has its lowest layoff rate of 2.4% in 2000, accompanied by a 78% financial loss in the case of layoffs, thus a 2%(=2.4%·78%) expected economic loss for state-owned enterprise workers. The differences in timing and province in the layoff rate and financial loss provide exogenous variation in parental economic insecurity.

In the estimations, I use the most recent three years' average layoff rate and financial loss by province for three reasons. First, as the current economic situation is pending, parents tend to form their economic expectations using information from the past. Second, unlike psychological measures, weight gain is a cumulative process, which takes a long-term change in habits to observe. Third, the 3-year average allows the intergenerational effects to be transmitted from parents to children. The average of the most recent two years and the lagged layoff rate are also tested; the results are highly consistent.

Person-specific layoff status could be correlated with individual characteristics (for example, female older employees with lower skills are more likely to be laid off). To eliminate the unobserved person-specific effects, I use the layoff policy for state sector employees in a given province and year, which is exogenous with respect to child outcomes. In China, the Hukou, or the national household registration binds families to their birth place. Little across-province mobility is allowed to maintain the eligibility of children's schooling, social benefits, job opportunities, and local benefits. Second, the layoff policy is associated with provinces with a high heavy-industry concentration. These industry arrangements were formed prior to the reform based on the strategic location, such as mineral deposits and gas fields. Even with the deterioration in job stability, income and benefits in the state sector, state sector workers still have little incentive to move to the non-state sector. The average income and health care in the state sector is significantly higher, even after the state-sector reform. Thus, individuals are unlikely to respond to the risk of layoff by voluntary job quitting.

3.4.5 State sector and non-state sector

The treatment group in the study is children in families where parents are in the state sector, and the control group is the non-state sector.[2] The key variable to identify the state sector and non-state sector is the question:

In what type of work unit do you work?
1 state enterprise or institute
2 small collective
3 large collective
4 joint venture
5 individual or private
6 other
7 unknown

If either parent answered "1 state enterprise or institute", then the child is identified in the state sector, i.e., treatment group. If either parent answered "2 small collective" or "3 large collective", then the child is considered to be in the collective sector. The rest of the children are in the control group, i.e., the non-state sector. Though not all state-sector families are laid off, all the state-sector employees experience a change in their degree of economic insecurity due to the increased chances of being laid off. Therefore, the treatment of greater economic insecurity is inflicted on all state sector workers. I identify the state sector (State=1) as the children whose parent or parents worked in the state sector in 1989 or the next available pre-reform cycle in 1991 and 1993.[3] Classification of children in the state sector is at the household level. In the sample 10% of the fathers, and 6% of the mothers worked in the state sector before the reform. In total the state sector accounted for 12% of children.

The non-state sector is defined as children both of whose parents worked in the non-state sector in 1989, or the next available pre-reform waves in 1991 and 1993. These children should not experience a direct effect from the layoff policy in the

[2]See Appendix for the official definition of the state sector and non-state sector.

[3]Children are identified in the state sector if one parent worked in the state sector, while the other parent worked in the non-state sector.

state sector. The collective sector (enterprises run by the provincial or local government) is excluded from the analysis because it is a hybrid sector, bridging the private and the state sectors.

3.5 Descriptive Statistics

Table 3.3 describes the outcome variable, average layoff rate, financial loss, equivalent income, family characteristics, province and the year structure in the state sector compared to the non-state sector. The average BMI Z-score in the state sector is -0.37, compared to -0.57 in the state sector. The negative mean coincides with previous findings that Asian population has lower BMI than international standards generated by other ethnicities (Ko et al., 1999; Deurenberg et al., 2000). The BMI Z-score has a similar standard deviation across the state and non-state sector, suggesting a relatively homogeneous distribution around the mean.

The CHNS constructed the annual sum of all sources of income adjusted for CPI from nine sources, including business, farming, fishing, gardening, livestock, non-retirement wages, retirement income, subsidies and other income. The equivalent income is generated by using the household net income divided by the square root of the household size (The Luxembourg Income Study Equivalent Scale). The average equivalent income is 10,807 in 2009 yuan in the state sector, compared to 7,534 in the non-state sector. The standard deviation is higher in the non-state sector. This indicates a lower income level but a higher income inequality in the non-state sector.

There are 1,730 children in the longitudinal sample, or 2,636 observations in pooled cross-sectional sample. The average child is 12.7 years-old, the father is 41, and the mother is 39 in both sectors. The average number of children in the family is 2.1 in the non-state sector, and 1.4 in the state sector. The larger family size is due to the proportion of rural population in the sample, the One Child Policy having been implemented less stringently in rural areas (Hesketh, Lu & Xing, 2005). In the non-state sector, 11% of fathers have no schooling (base), while 17% have high school and above. In the state sector, 5% of fathers have no schooling, and 56% have high school degree and above. The remainders is in primary schooling and middle schooling categories. The mother's education is lower than the father's in

both sectors, but the state sector is higher than the non-state sector.

Rural residents consist of 83% of the non-state sector, and 39% of the state sector. At the provincial level, the state and the non-state sector are evenly distributed except for a higher state sector composition in Liaoning province, where state-owned mining and manufacturing are prominent industries historically. In the pooled cross-sectional sample, cycles of 1997, 2000, and 2004 contribute to 48% (N=1,389), 42% (N=994) and 10% (N=253) of the sample respectively.

Compared to the control group (i.e., the non-state sector), the treatment group (i.e., the state sector) has higher equivalent income, child's BMI Z-score, parents' education, and urban ratio. These pre-policy differences, as well as the time-invariant unobservable (e.g., ability), are controlled by the individual fixed effects of the difference-in-difference methodology (Angrist & Pischke, 2008).

Apart from individual characteristics, the real GDP per capita by province and year is also used to control for province-specific trends. Robustness checks are done using the secondary enrollment rate, the CPI, the birth rate, population, urban disposable income, average living expenditure, and the saving rate. The key results of the estimation are highly consistent.

3.6 Identification: The Impact of Layoff Policy on Child Weight Gain

3.6.1 Continuous difference-in-difference

To evaluate the causal effects of parental economic insecurity on child outcomes, I adopt a continuous difference-in-difference framework with individual fixed effects. The idea underlying the identification strategy is to compare not only the differences between the state sector and the non-state sector, but also variations in outcomes that result from different degrees of treatment, i.e. expected income loss defined as layoff rate multiplied by the income fall for laid-off workers.

The baseline continuous difference-in-difference regression model is as follows:

$$Y_{ipt} = \alpha_i + \alpha_1 State_{ip} \cdot LayoffRate_{pt} \cdot FinancialLoss_{pt} + \alpha_2 LayoffRate_{pt} \cdot FinancialLoss_{pt} + \mathbf{W_{it}}\theta + e_{ipt} \quad (3.11)$$

in which Y_{ipt} is the BMI Z-score, weight for age Z score, and waist to height ratio for child i in year t. $State_{ip}$ identifies the treatment group. $LayoffRate_{pt}$ is the layoff rate for province p in year t, which measures the possibility of being laid off. $FinancialLoss_{pt}$ is the average financial loss of laid-off state sector workers for province p and year t, which measures the percentage of economic downfall in the event of a layoff. $LayoffRate_{pt} \cdot FinancialLoss_{pt}$ captures the possibility of job loss times the severity of financial loss of layoff, which is the expected economic loss. The vector of covariates, W_{it}, includes log equivalent income and number of children in the family. The coefficient α_2 is the average difference in outcomes across the province and is the same for both the treatment and the control groups. The coefficient of interest, α_1, is the extra layoff rate effects that only affects the treatment group, i.e., the state sector. The hypothesis is that provinces featuring a high layoff rate have high BMI Z-scores in the state sector. Hence, α_1 is expected to be statistically significant with a positive sign. α_i is the permanent unobservable person-specific characteristics. By using individual fixed effects, the unobserved time-invariant characteristics are differenced out, and the average effects remain in the estimation. All regressions are estimated separately for girls and boys. The standard errors are clustered at the provincial level.

The second specification decomposes economic insecurity (i.e. expected economic loss) by separating the possibility of job loss and the severity of financial loss if laid off:

$$Y_{ipt} = \beta_i + \beta_1 State_{ip} \cdot LayoffRate_{pt} + \beta_2 State_{ip} \cdot FinancialLoss_{pt} + \beta_3 LayoffRate_{pt} + \beta_4 FinancialLoss_{pt} + \mathbf{W_{it}}\vartheta + \epsilon_{ipt} \quad (3.12)$$

The variables of interest are $State_{ip} \cdot LayoffRate_{pt}$(changes in layoff rate in state sector by province), and $State_{ip} \cdot FinancialLoss_{pt}$ (changes in financial loss in state sector if laid off). The coefficients β_1 and β_2 are expected to be positive, which suggests that a high economic loss is associated with a high weight gain.

3.6.2 Parallel trend

The panel difference-in-difference identification assumes that the outcomes in the treatment group (i.e., the state sector) and the control groups (i.e., the non-state sector) would have been the same in the absence of treatment (i.e., follow parallel trends). Figure 6 presents child outcome variables for treatment and control groups over time. For the non-state and the state sector, the BMI Z-score, the weight-for-age Z-score, and the waist-to-height ratio exhibit the same trends before the reform in 1993, diverge during the reform in 1997 and 2000, and converge after the reform in 2004. Note that for outcome variables, the data are available from 1989 to 2004, while the layoff rate is only available from 1995 to 2005. Therefore, the parallel trend can be generated using a broader time span, while the regression analyses are done using the data from 1997 to 2004.

3.7 Main Results

To illustrate the magnitude of the coefficients, I will use a 10-percentage-point difference in expected economic loss between the most affected province Liaoning in 2000 (12% expected economic loss), and the least affected province Shandong in 1997 (2% expected economic loss). From the coefficient of $LayoffRate \cdot State$ (the additional effects on state sector from the non-state sector), the numeric examples show if layoffs increase by 10 percentage points, how many standard deviations will affect the outcome variables. Also, I will use a more intuitive example: if a 10-year-old child was at the 50th percentile of the weight measures, then a 10-percentage-point increase in expected economic loss would move the child to which percentile.

Table 3.4 presents the individual fixed effects estimates of the continuous difference-in-difference model of children's BMI Z-score, weight for age Z-score, and waist to height ratio for girls and boys respectively. In specification 1, the variable of interest is $FinancialLoss \cdot LayoffRate \cdot State$. A positive and significant coefficient suggests that the layoff policy by province and year increases weight gain in children from the state sector more than those from the non-state sector. The interaction of $FinancialLoss \cdot LayoffRate$ captures the overall effects of layoffs in both the

state and the non-state sector. In Specification 2, I evaluate the differential effect of economic loss by decomposing economic insecurity into $LayoffRate \cdot State$ and $FinancialLoss \cdot State$, which captures the possibility of job loss and the severity of financial loss.

According to columns (1), (3), and (5) of Table 3.4, $FinancialLoss \cdot LayoffRate \cdot State$ is positive and significant for boys, suggesting that the reform significantly increases boys' BMI Z-score, weight-for-age Z-score, and waist-to-height ratio in the state sector relative to the non-state sector. In terms of the magnitude, when expected economic loss by layoff policy increases by 10 percentage points, the BMI Z-score increases by 1.32 units (=13.2*10%), equivalent to a 1.22 standard deviation (= $1.32/StandardDevation_{bmiZ}$) increase in BMI Z-score distribution in the sample. If a 10-year-old boy who starts at 50th percentile of the BMI Z-score, the layoff effects would increase his BMI Z-score to 86th percentile. Similarly, a 10 percentage increase in expected economic loss increases boy's weight-for-age Z-score by 0.9 units, or 0.84 standard deviations. The effect is equivalent to a rise of a 10-year-old boy from the 50th percentile to the 77th percentile of the weight-for-age Z-score distribution. The waist-to-height ratio increases by 0.05 units, or 1.16 standard deviations, which would move a median 10-year-old boy to 90th percentile in waist-to-height distribution.

The three outcome variables in weight provide multi-dimensional but consistent results in children's weight gain in the state sector when there is an increase in expected economic loss in the state sector. The BMI Z-score, weight-for-age Z-score and waist-to-height ratio are all positive and significant for boys, but not girls. This suggests that compared to the non-state sector, boys in the state sector increase weight *because of* the change in layoff policy in the state-owned enterprise reform.[4]

Specification 2 of Table 3.4 shows estimates of the probability of job loss ($LayoffRate \cdot State$) and the severity of financial loss ($FinancialLoss \cdot State$). The results suggest that the layoff rate is positive and significant for boys' BMI Z-score, weight for age Z-score, and waist-to-height ratio, while the $FinancialLoss \cdot State$ is positive and significant for weight-for-age Z-score. The estimates show that the probability

[4]The gender difference is significant for all three outcome variables by including gender interaction with $FinancialLoss \cdot LayoffRate \cdot State$ in pooled-girls-and-boys sample.

of job loss has a higher impact than the severity of financial loss.
This finding is consistent with the happiness literature. Di Tella, MacCulloch and Oswald (2001) show that to remain the same level of life satisfaction, people would trade a 2-percentage-point increase in the inflation rate (equivalent to financial loss) with a 1-percentage-point increase in the unemployment rate (the probability of job loss). Helliwell and Huang (2014) estimate the non-monetary cost of unemployment on subjective well-being is 15 times larger than the financial loss from unemployment itself. This chapter also suggests that child health outcomes are more prone to be affected by probability of job loss than financial loss from unemployment.

3.8 Further Results

3.8.1 Estimation on no actual job loss sample

The main results above show that weight gain in boys is associated with parental economic insecurity. I extend the hypothesis further to weight gain in children without parental employment change. Economic insecurity is found not only in the event of job loss, but also in the "anticipation" of job loss. By limiting the sample to children whose parents always have the same job, the hypothesis supports the purpose of this study, which is estimating the effects of economic insecurity rather than the effects of layoff alone.
Economic insecurity is about the anxiety regarding anticipated events. I re-estimate the 'perceived' job loss separately from 'actual' job loss. Although a severe layoff policy can still cause laid-off workers increased difficulties with re-employment, once state-owned workers are laid off, the feared event has happened, so uncertainty has been resolved. To separate the confounding factor, I further limit the sample to children whose parents always have jobs at the time of the interview and who haven't changed their jobs since the last survey (1206 children are excluded). By limiting the 'always having a job' sample and employing the same continuous difference-in-difference model, the results provide 'perceived' effects on job loss.
Table 3.5 presents the results of the "never lost job" sample. Column 1 shows the *Financial*

$Loss \cdot Layoff Rate \cdot State$ is still significant and positive for boys. The magnitude of the coefficient is reduced from 13.15 in the full sample estimation to 6.13 in the never lost job sample. If the expected economic loss increases by 10 percentage points, the BMI Z-score increases by 0.61 points, or 0.58 standard deviations. The effect would increase a 10-year-old boy from the 50th percentile to the 72nd percentile. The waist-to-height ratio becomes significant for girls. An increase in 10-percentage-point in expected economic loss, the waist-to-height ratio increases by 0.068, or 1.66 standard deviations. Such effect increases a 10-year-old girl at 50th percentile to 90th percentile at waist-to-height distribution.
Specification 2 of Table 3.5 presents estimates of the differential effects of economic insecurity. Boys' BMI Z-score increases as does $FinancialLoss \cdot State$ and $Layoff Rate \cdot State$. This indicates that the intergenerational effects of economic insecurity come from both the probability of job loss and the severity of financial loss of unemployment. Columns (5) and (6) of Table 3.5 suggests that waist-to-height ratio increases with the financial loss for boys, and increases with layoff rate for girls.

3.8.2 Quantile regression on pooled cross-sectional sample

I further question whether parental economic insecurity results in higher weight gain in children who already have higher BMIs than their peers. This hypothesis implies a negative consequence on children's health, if supported. The OLS results estimate the average effects, while the weight gain caused by economic insecurity is not necessarily linear. Rohde et al., (2016) use quantile regressions on Australia panel data and find that the effects of economic insecurity on weight gain are higher in the overweight population, which implies that repeated stress has a cumulatively worse impact. To investigate the different impacts on children with a different level of weight, I employ a quantile regression on pooled cross-sectional sample. By using a pooled sample, observations that appeared once in the longitudinal dataset are also included. The model of estimation is as follows:

$$Y_{ip} = \gamma_0 + \gamma_1 State_{ip} \cdot Layoff Rate_p \cdot FinancialLoss_p + \gamma_2 Layoff Rate_p \cdot FinancialLoss_{pt} + \mathbf{Z_i}\delta + \xi_{ipt} \quad (3.13)$$

where Y_{ip} is BMI Z-score, weight-for-age Z-score, and waist-to-height ratio for child i in province p in the pooled sample. State, FinancialLoss, and LayoffRate are defined the same as in the baseline estimation. I further control for children's age, age squared, and age cubed to capture not only the increase, but also the different growth rate (curvature) of the children. The age and education of father and mother, the rural dummy, and the province of residence are added to control for observed characteristics. The primary objective of this model is to test if γ_1, the coefficient of $State_{ip} \cdot LayoffRate_p \cdot FinancialLoss_p$ increases with children's weight measures, i.e. if the higher γ_1 is associated with a higher weight quantile.

Table 3.6 presents the estimates of quantile regressions for a pooled cross-sectional sample of boys at the 0.05, 0.1, 0.2, 0.5, 0.8, 0.9 and 0.95 quantile. For boys' waist-to-height ratio, the estimates of $State_{ip} \cdot LayoffRate_p \cdot FinancialLoss_p$ are positive and significant at q=0.5 ($\gamma_1 = 0.2$), q=0.8 ($\gamma_1 = 0.4$), and q=0.95 ($\gamma_1 = 0.59$). The quantile regressions suggest that when children are at the top of the distribution of waist-to-height ratio (already too fat), a stronger layoff policy increases their waistline even more. Their girl counterparts do not present significant effects of $State_{ip} \cdot LayoffRate_p \cdot FinancialLoss_p$ in the quantile estimation (see Table 3.7).

Figure 7 shows the plot of the coefficient of $State_{ip} \cdot LayoffRate_p \cdot FinancialLoss_p$ across all quantiles. Compared to OLS, the coefficient of $State_{ip} \cdot LayoffRate_p \cdot FinancialLoss_p$ at the bottom distribution is below the 95% CI in the OLS for boys' BMI Z-score, while the top distribution is above the 95% CI in the OLS for boys' waist-to-height ratio. The patterns for girls are less distinct than for boys. The quantile regressions suggest that the effects of economic stress are not linear for boys, as it makes the thin boy thinner and adds more weight to already obese boys. As being too thin or too fat are both problematic for health, the results here pose a more serious problem than the OLS estimation suggests.

In general, the quantile regressions show that the effects of parental economic insecurity (i.e., layoff effects) on weight gain are not linear. The results suggest a larger weight gain is found by the layoff policy in the state sector for heavier children. This supports the hypothesis that the health effects of parental economic

insecurity on weight gain are more statistically significant, and have a higher magnitude, at the higher ends of the BMI Z-score, the weight-for-age Z-score, or waist-to-height ratio.

The results provide strong evidence that the layoff policy contributes to obesity rather than eliminating underweight from malnutrition: the children in the lower quantiles of weight are not affected, while the effects weight-gaining become stronger as the increase in weight quantiles.

3.8.3 Rural and urban sample

As a robustness check, I separate rural and urban sample for continuous difference-in-difference estimation. Table 3.8 shows the estimates. In the urban sample, there are 377 children in the urban sample, of which 133 children's parents work in the state sector. The results show that girls' waist-for-height ratio is positive and significant for $State_{ip} \cdot LayoffRate_p \cdot FinancialLoss_p$. In the rural sample, there are 1328 children in the longitudinal sample, and 88 children among which belong to the state sector. The results suggest that BMI Z-score increases significantly with $State_{ip} \cdot LayoffRate_p \cdot FinancialLoss_p$ for both boys and girls. The *weight-for-age Z score* and *waist-to-height ratio* are significantly positive for boys. It shows that rural sample is more significantly affected by the layoffs, but the smaller effects in the urban sample are potentially due to the small sample size. In general, it reinforces the previous results that a severe layoff policy increases in children's weight measures.

3.9 Conclusion

This chapter is the first one to examine intergenerational effects of parental economic insecurity on children's weight gain. Using the natural experiment of the large-scale layoffs during the China's state-owned enterprise reform in the late 1990s, I calculate the expected economic loss using layoff rates and average financial loss in the state sector at provincial- and year-levels. Compared to children in the non-state sector (control group), children in the state sector (treatment group) experience different levels of expected economic loss due to changes in layoff policy (treatment of different intensity). Exploiting this exogenous variation in parental

economic insecurity, I use a continuous difference-in-difference methodology to examine the weight-related outcomes.

To adjust for age and gender specific growth standards, I use the BMI Z-score (WHO standard), and the weight-for-age Z-score (CDC standard). A non-racial dependent outcome, waist-to-height ratio, is also used to account for the body fat distribution, and is a more reliable indicator of health risks than weight alone. Using the longitudinal data from the China Health and Nutrition Survey (CHNS), individual fixed effects are used to control for time-invariant observable and unobservable characteristics.

Compared to the non-state sector, there are considerable increases in the BMI Z-score, weight-for-age Z-score, and waist-to-height ratio in boys in the state sector in the response to the expected economic loss in the state sector. If the expected economic loss increases by 10 percentage points (the difference between the highest and the lowest treatment effects of layoff policy at provincial- and year-levels) the BMI Z-score increases by 1.22 standard deviations, the weight-for-age Z-score increases by 0.84 standard deviations, and the waist to height ratio increases by 1.16 standard deviations for boys. In other words, if parental economic insecurity increases by 10 percentage points, then a boy from median weight distribution would move to the 86th percentile in the BMI Z-score, the 77th percentile in the weight-for-age Z-score, and the 90th percentile in the waist-to-height ratio. The layoff rate and financial loss from the layoffs are used to examine the differential impact of economic insecurity. The layoff rate (i.e., the probability of job loss) plays a greater role than the financial loss in the determination of children's weight change.

After limiting the sample for parents always having jobs, the BMI Z-score is still significantly affected by the layoff policy for boys in the state sector. Girls' waist-to-height ratio also significantly increases with the parental economic insecurity. If the expected economic loss increases by 10 percentage points, even without any parental job change or job loss, boys' BMI Z-score is expected to increase by 0.58 standard deviations, or a 22 percentile increase, and girls' waist-to-height-ratio is expected to increase by 1.66 standard deviations, or a 40 percentile increase.

By employing quantile regressions, I test the hypothesis that parental economic insecurity does not affect all children equally. Weight gain resulting from parental economic insecurity is especially high for boys who already have a higher weight. It suggests that parental economic insecurity induces "fat children to become fatter", which adds significantly higher social costs to health expenditure than previously estimated using the OLS model.

This study highlights that layoffs have severe consequences on children in the families. When performing economic reform, policy-makers should take the intergenerational health effect into considerations for the cost-benefit analysis, as child obesity significantly increases public health costs. Parental job loss has significant negative impact on child obesity, which suggests that a much higher public health cost is associated with unemployment than previous studies suggested. In the event where job losses have already occurred a social safety net is important to reduce the negative impact on children. Adequate unemployment insurance benefits, effective job training programs, and accessible social assistance can effectively protect families against expected economic loss, thus reducing the negative effects on children. Also, the increased child obesity calls for social and school programs to promote children's daily physical activities and educate parents and children themselves for better nutrition choices.

The findings show that boys' weight gain is affected by parental economic insecurity more than girls. There are several potential explanations: First, boys in China face higher parental pressure, especially due to the unbalanced gender ratio in the marriage market. Chinese culture has long-rooted boy preference (Almond, Edlund & Milligan, 2013) and the One Child Policy aggravated gender selection (Ebenstein, 2010). Prior to the state sector reform, the gender ratio was 106 males to 100 females (Johansson & Nygren, 1991), which resulted in a more competitive marriage market for men. Das Gupta et al. (2010) shows that Chinese men with higher education are less likely to be single. It is plausible that boys experience increased pressure to gain higher socioeconomic status, especially when parents face economic downturns. Chinese women's education, on the other hand, is not correlated with the marriage rate, so the pressure on women to gain high socioeconomic status is less.

Second, sons in China share more responsibilities in taking care of elderly parents than daughters (Zhou, 2014). With the under-developed financial market, protection against economic insecurity still relies on borrowing capacity of family members (Cai et al., 2013). In events of economic insecurity, such as unemployment, sickness, old age, and widowhood (death of husband/father) (Osberg, 2015a), sons share the risks of financial downturn and the cost of supporting parents. Daughters, on the contrary, are considered "married off" to other households once they reach adulthood. Therefore, it is likely that parents pass on their economic anxiety to sons more than daughters, and sons are more likely to assume that economic responsibilities.

Third, the notion of body image may also explain such differences: girls may prefer a slim body image, while teenage boys value a bulkier body (Demarest & Allen, 2000). Girls tend to be more concerned about being overweight, and associate dissatisfaction of body image with lower self-esteem. Such findings are not applicable to boys (Furnham, Badmin & Sneade, 2002). In the presence of parental economic insecurity, boys tend to gain weight.

Fourth, girls may react to a change in the family environment change differently from boys (Bezirganian & Cohen, 1992). An epigenetic study shows that girls tend to internalize stress (Essex et al., 2003) and parental economic insecurity may induce mental health challenges, such as anxiety or depression. The CHNS dataset does not provide a subjective measure or indicator of mental health. This is one of the limitations of this study, and future research will be enhanced if measures of mental health for parents and children are included.

In this chapter, the average financial loss of laid-off workers is calculated from the average living subsidies of laid-off workers compared to the average wage of on-post state sector workers in the province at the same period of time. This provides the closest approximation in the average income fall that a laid-off worker experiences, given data available. Giles, Park and Cai (2006) indicate that the state-owned enterprise reform also reduces the wage of the remaining state sector workers. The proportionate financial loss of laid-off workers is calculated using the wage level of the remaining state sector workers. Therefore, the financial loss may be underestimated. Another limitation comes from the lack of reputable overweight

standard specifically for current Chinese children in existing literature. Although the BMI Z-score, and the weight-for-age Z-score provide an age-gender-specific reference for weight gain using international samples but they do not accurately identify the thresholds for overweight or obese for Chinese children. Future research can be done when such thresholds are established.

Table 3.1: Number of observations by number of appearance in the longitudinal sample and survey year.

Occurrences	Year		
	1997	2000	2004	Total
1	659	285	26	970
2	584	563	81	1,228
3	146	146	146	438
Total	1,389	994	253	2,636

Note: CHNS sample of families with children from 1997 to 2004. The column shows the number of times the same children in the study, and the row shows the survey cycles. For example, in 2000, 1205 children have shown in the survey for the second time, 251 children for the first time. In the longitudinal sample, and there are 1023 children in the sample that we observe twice, and 578 children we observe three times from 1997 to 2004.

Table 3.2: Age and year structure of longitudinal sample

Age	1997	2000	2004	Total
4	30	0	0	30
5	39	0	0	39
6	62	0	0	62
7	81	28	0	109
8	115	38	0	153
9	131	61	0	192
10	152	78	0	230
11	141	114	25	280
12	126	123	24	273
13	108	138	27	273
14	108	136	32	276
15	95	99	54	248
16	86	75	35	196
17	69	63	33	165
18	46	41	23	110
Total	1,389	994	253	2,636

Note: CHNS sample of families with children from 1997 to 2004.

Table 3.3: Descriptive statistics by the non-state sector and the state sector.

	Non-State Sector				State Sector			
Variables	Mean	S.D.	Min	Max	Mean	S.D.	Min	Max
BMI Z-score	-0.57	1.06	-5.00	4.20	-0.37	1.16	-3.81	3.34
Weight-for-age Z-score	-1.18	1.05	-4.83	2.23	-0.67	1.10	-4.81	1.99
Waist-to-height ratio	0.43	0.04	0.31	0.74	0.43	0.04	0.30	0.60
FinancialLoss*LayoffRate	0.05	0.03	0.00	0.12	0.05	0.03	0.00	0.12
LayoffRate	0.06	0.03	0.00	0.15	0.06	0.04	0.00	0.15
FinancialLoss	0.80	0.05	0.69	0.88	0.80	0.05	0.69	0.88
Equivalent Income	7534	6419	0	69402	10807	8006	0	83905
Number of children	2.12	0.84	1	6	1.38	0.54	1	3
Number of extra hh members	2.66	0.97	1	7	2.48	0.87	1	6
Prov GDP per capita	6879.70	3424.23	2736.92	22969.12	7177.78	3495.32	2736.917	22969.12
Number of observations	2292				344			

Source: CHNS sample from 1997 to 2004. Note: Equivalent income is household income after tax and transfer adjusted by square root of household size (the Luxembourg Income Study Equivalent Scale).
Number of extra household members are defined as household size minus number of parents minus number of children.

Table 3.4: Continuous Difference-in-Difference Estimates with Individual Fixed Effects. Full Sample.

	BMI Z-score		Weight-for-age Z-score		Waist-to-height ratio	
	Boy	Girl	Boy	Girl	Boy	Girl
Specification 1	(1)	(2)	(3)	(4)	(5)	(6)
FinancialLoss*Layoff rate*State	13.15**	14.52	8.955**	3.061	0.495*	0.62
	[3.953]	[9.679]	[2.713]	[8.673]	[0.221]	[0.353]
FinancialLoss*Layoff rate	-4.453**	-3.780**	-0.456	0.211	-0.18	-0.125
	[1.300]	[1.593]	[0.525]	[1.450]	[0.121]	[0.176]
Log eq hh income	0.0264	-0.0658	0.00358	-0.0295	0.00176	-0.00655*
	[0.0373]	[0.0496]	[0.0317]	[0.0463]	[0.00177]	[0.00296]
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,505	1,244	1,545	1,283	1,473	1,231
R-squared	0.043	0.035	0.015	0.058	0.069	0.051
Number of IDind	954	826	972	845	948	825
Specification 2						
FinancialLoss*State	-1.542	-1.479	3.093**	0.431	-0.0222	0.0343
	[3.054]	[2.762]	[1.189]	[3.969]	[0.102]	[0.115]
Layoff*State	9.140*	9.985	8.016***	1.816	0.359**	0.474
	[3.901]	[6.958]	[1.872]	[6.402]	[0.150]	[0.267]
Financial Loss	-0.0329	0.171	-0.222	-2.493*	0.123	0.164*
	[1.419]	[1.095]	[2.089]	[1.139]	[0.0660]	[0.0834]
Layoff Rate	-3.282**	-2.667	-0.213	-0.963	-0.0682	-0.00596
	[1.385]	[1.488]	[1.089]	[0.943]	[0.0731]	[0.161]
Log eq hh income	0.0276	-0.0707	0.00139	-0.0353	0.00187	-0.00626*
	[0.0371]	[0.0517]	[0.0307]	[0.0431]	[0.00168]	[0.00296]
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,505	1,244	1,545	1,283	1,473	1,231
R-squared	0.043	0.036	0.018	0.066	0.078	0.062
Number of IDind	954	826	972	845	948	825

Note: Robust standard errors clustered in provincial level in brackets. *** p<0.01, ** p<0.05, * p<0.1 Layoff rate and financial loss are recent 3-year average at provincial level. Other controls include number of children in households, number of extra household members and GDP per capita in province. A constant is included. The sample consists of families with children in the state sector and non-state sector from 1997 to 2004 for 7 provinces in CHNS dataset.

Table 3.5: Continuous Difference-in-Difference Estimates with Individual Fixed Effects. Never lose job sample.

	BMI Z-score		Weight-for-age Z-score		Waist-to-height ratio	
	Boy	Girl	Boy	Girl	Boy	Girl
Specification 1	(1)	(2)	(3)	(4)	(5)	(6)
FinancialLoss*Layoff rate*State	6.137*	7.776	9.952	2.357	-0.174	0.680**
	[3.155]	[9.754]	[6.076]	[11.59]	[0.101]	[0.217]
FinancialLoss*Layoff rate	-4.334**	-2.111	-0.428	0.746	-0.320**	-0.203
	[1.248]	[1.139]	[2.040]	[1.761]	[0.112]	[0.145]
Log eq hh income	0.0803**	0.0425	0.026	0.0337	0.00299	-0.00174
	[0.0312]	[0.0743]	[0.0276]	[0.0437]	[0.00197]	[0.00123]
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,024	860	1,050	878	1,003	849
R-squared	0.052	0.023	0.034	0.077	0.122	0.026
Number of IDind	679	596	690	605	673	596
Specification 2						
FinancialLoss*State	7.768***	-2.291	1.823	-0.0621	0.310*	0.0129
	[1.562]	[4.584]	[2.260]	[5.081]	[0.152]	[0.0867]
Layoff*State	10.60***	4.689	8.71	0.619	0.039	0.519**
	[2.346]	[6.764]	[4.874]	[8.657]	[0.193]	[0.165]
Financial Loss	-1.948	-0.486	-1.676	-2.505***	0.137	0.0654
	[1.267]	[1.388]	[2.299]	[0.647]	[0.0816]	[0.0638]
Layoff Rate	-4.258**	-1.762	-1.095	-0.778	-0.151*	-0.103
	[1.280]	[1.291]	[2.190]	[0.795]	[0.0682]	[0.141]
Log eq hh income	0.0795**	0.042	0.029	0.0366	0.00259	-0.00189
	[0.0265]	[0.0730]	[0.0262]	[0.0425]	[0.00193]	[0.00128]
Other Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,024	860	1,050	878	1,003	849
R-squared	0.059	0.025	0.04	0.088	0.146	0.028
Number of IDind	679	596	690	605	673	596

Note: Robust standard errors clustered in provincial level in brackets. *** p<0.01, ** p<0.05, * p<0.1 Layoff rate and financial loss are recent 3-year average at provincial level. Other controls include number of children in households, number of extra household members (number of household members-number of children-number of parents), and CPI adjusted GDP per capita in province. A constant is included. The sample consists of families never lost or changed job with children in the state sector and non-state sector with the exclusion of collective sector from 1997 to 2004 for 7 provinces in CHNS dataset.

Table 3.6: Quantile regressions using pooled CHNS sample. Boys sample.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Q=0.05	Q=0.1	Q=0.2	Q=0.5	Q=0.8	Q=0.9	Q=0.95
				BMI Z-score			
FinancialLoss*Layoff rate*State	-4.948	5.127	4.977	4.729	11.17***	5.912	3.663
	[6.187]	[6.962]	[4.431]	[3.252]	[4.190]	[5.577]	[5.923]
FinancialLoss*Layoff rate	-11.31**	-3.031	-0.902	0.968	0.187	5.489	2.86
	[4.859]	[5.467]	[3.479]	[2.553]	[3.290]	[4.380]	[4.651]
State	-0.323	-0.338	-0.194	-0.276	-0.219	0.13	0.233
	[0.357]	[0.402]	[0.256]	[0.188]	[0.242]	[0.322]	[0.342]
				Weight-for-age Z-score			
FinancialLoss*LayoffRate*State	3.872	7.313	5.286	3.625	5.872	5.859	5.231
	[4.487]	[4.998]	[4.140]	[3.158]	[3.705]	[4.119]	[4.448]
FinancialLoss*Layoff rate	1.42	1.265	0.903	-0.932	-0.482	3.094	4.023
	[3.528]	[3.929]	[3.255]	[2.482]	[2.913]	[3.238]	[3.497]
State	-0.0789	-0.162	0.00796	0.179	0.126	0.219	0.273
	[0.261]	[0.291]	[0.241]	[0.184]	[0.215]	[0.239]	[0.259]
				Waist-to-height ratio			
FinancialLoss*Layoff rate*State	0.154	0.177	0.162	0.203*	0.399**	0.412	0.586**
	[0.187]	[0.162]	[0.117]	[0.113]	[0.189]	[0.269]	[0.280]
FinancialLoss*Layoff rate	0.161	0.0358	-0.0456	-0.0566	0.0372	-0.12	0.0571
	[0.152]	[0.132]	[0.0951]	[0.0922]	[0.154]	[0.218]	[0.227]
State	-0.0134	-0.0210**	-0.0202***	-0.0106	-0.0151	-0.0136	0.00415
	[0.0110]	[0.00949]	[0.00684]	[0.00663]	[0.0110]	[0.0157]	[0.0163]

Note: Robust standard errors clustered in provincial level in brackets. *** p<0.01, ** p<0.05, * p<0.1 Layoff rate and financial loss are recent 3-year-average at provincial level. Other controls include number of children in households, number of extra household members (number of household members-number of children-number of parents), and CPI adjusted GDP per capita in province. A constant is included. The sample consists of pooled cross-sectional families with boys in the state sector and non-state sector with the exclusion of collective sector from 1997 to 2004 for 7 provinces in CHNS dataset.

Table 3.7: Quantile regressions using pooled CHNS sample. Girls sample.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Q=0.05	Q=0.1	Q=0.2	Q=0.5	Q=0.8	Q=0.9	Q=0.95
				BMI Z-score			
FinancialLoss*Layoff rate*State	-5.34	-3.073	2.146	-3.581	-5.501*	-1.007	5.787
	[7.302]	[5.554]	[4.013]	[3.000]	[3.275]	[5.150]	[5.920]
FinancialLoss*Layoff rate	-3.116	-6.216	-7.145**	-2.939	-0.323	-1.969	-3.442
	[6.197]	[4.713]	[3.405]	[2.545]	[2.779]	[4.371]	[5.024]
State	0.113	-0.142	-0.3	0.109	0.434**	0.451	0.0565
	[0.444]	[0.338]	[0.244]	[0.183]	[0.199]	[0.313]	[0.360]
				Weight-for-age Z-score			
FinancialLoss*Layoff rate*State	-7.056	-4.545	-6.375	-3.807	0.151	-0.112	-2.846
	[7.979]	[5.895]	[4.383]	[3.105]	[3.695]	[3.960]	[5.281]
FinancialLoss*Layoff rate	-2.51	0.62	-2.762	-3.734	1.003	0.578	2.669
	[6.771]	[5.002]	[3.719]	[2.635]	[3.135]	[3.360]	[4.481]
State	0.0782	0.101	0.331	0.231	0.274	0.309	0.382
	[0.489]	[0.361]	[0.268]	[0.190]	[0.226]	[0.243]	[0.323]
				Waist-to-height ratio			
FinancialLoss*Layoff rate*State	0.0276	0.0551	0.138	-0.0639	0.118	-0.142	-0.0924
	[0.185]	[0.175]	[0.158]	[0.132]	[0.161]	[0.243]	[0.435]
FinancialLoss*Layoff rate	-0.0112	0.0183	0.0926	0.0383	-0.218	0.0446	-0.203
	[0.162]	[0.153]	[0.138]	[0.115]	[0.141]	[0.213]	[0.380]
State	0.00412	-2.60E-06	-0.0155	-0.00757	-0.0104	0.00721	0.0014
	[0.0113]	[0.0107]	[0.00968]	[0.00808]	[0.00987]	[0.0149]	[0.0266]

Note: Robust standard errors clustered in provincial level in brackets. *** p<0.01, ** p<0.05, * p<0.1 Layoff rate and financial loss are recent 3-year-average at provincial level. Other controls include number of children in households, number of extra household members (number of household members-number of children-number of parents), and CPI adjusted GDP per capita in province. A constant is included. The sample consists of pooled cross-sectional families with girls in the state sector and non-state sector with the exclusion of collective sector from 1997 to 2004 for 7 provinces in CHNS dataset.

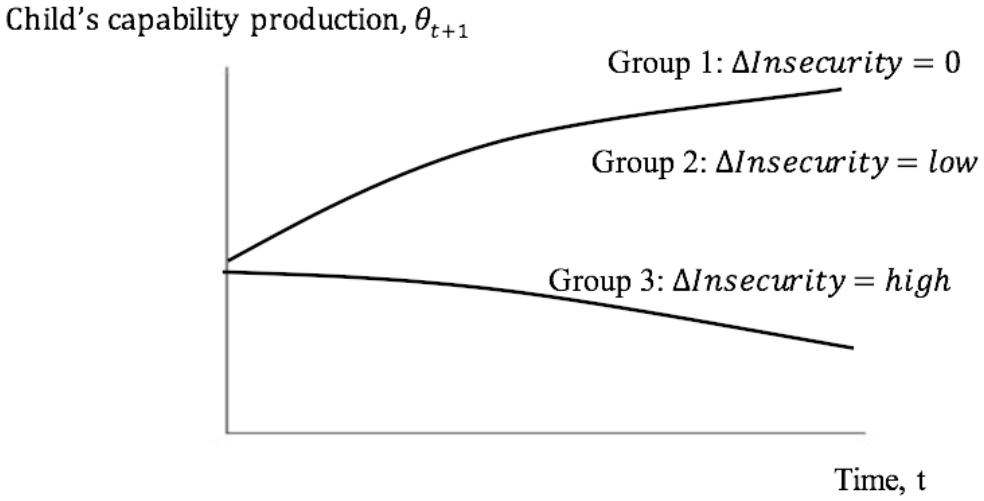
Table 3.8: Continuous Difference-in-Difference Estimates with Individual Fixed Effects. Urban and rural sample.

	Urban					
VARIABLES	BMI Z-score		Weight-for-age Z-score		Waist-to-height ratio	
	Boy	Girl	Boy	Girl	Boy	Girl
FinancialLoss*LayoffRate*State	11.54	8.460	2.047	-4.515	0.0901	0.692*
	[11.56]	[10.29]	[3.992]	[10.29]	[0.726]	[0.308]
FinancialLoss*LayoffRate	-8.800	-9.536	0.122	-2.563*	-0.0525	-0.248
	[6.500]	[5.078]	[4.400]	[1.297]	[0.363]	[0.668]
Log eq income	0.0730	0.118	-0.00263	-0.0480*	0.00957**	0.00263
	[0.0692]	[0.0717]	[0.0347]	[0.0233]	[0.00353]	[0.00753]
Number of extra hh members	0.201*	0.339	0.183***	0.355**	0.00113	-0.000832
	[0.102]	[0.188]	[0.0304]	[0.105]	[0.00294]	[0.0143]
puberty	-0.0511	0.256	0.0308	0.244*	-0.00676	0.00643
	[0.0508]	[0.204]	[0.124]	[0.122]	[0.00357]	[0.00722]
Prov GDP per capita (in 2009)	-9.13e-05***	-7.70e-05	-5.22e-05**	-6.96e-06	-2.81e-06	-1.09e-06
	[2.52e-05]	[5.46e-05]	[1.70e-05]	[1.68e-05]	[1.50e-06]	[3.60e-06]
Constant	-0.794	-1.639	-1.156**	-1.112***	0.367***	0.412***
	[0.508]	[1.002]	[0.358]	[0.207]	[0.0390]	[0.0907]
Observations	327	277	328	280	324	276
R-squared	0.106	0.095	0.065	0.101	0.077	0.030
Number of IDind	197	180	198	182	199	181
	Rural					
VARIABLES	BMI Z-score		Weight-for-age Z-score		Waist-to-height ratio	
	Boy	Girl	Boy	Girl	Boy	Girl
FinancialLoss*LayoffRate*State	22.89**	27.05*	17.54**	21.20	1.127**	0.964
	[8.304]	[11.55]	[6.408]	[11.88]	[0.414]	[0.561]
FinancialLoss*LayoffRate	-3.134	-5.314**	0.311	-1.778	-0.107	-0.195*
	[1.986]	[1.627]	[1.159]	[1.690]	[0.119]	[0.0908]
Log eq income	0.0193	-0.0993*	-0.00679	-0.0147	0.00181	-0.00942**
	[0.0499]	[0.0482]	[0.0451]	[0.0338]	[0.00162]	[0.00303]
Number of extra hh members	0.186*	0.0774	0.109	0.0738	0.00383	0.00360
	[0.0903]	[0.0672]	[0.0745]	[0.0523]	[0.00420]	[0.00733]
puberty	-0.0285	0.483***	-0.0709	0.329***	-0.00983	0.0126***
	[0.165]	[0.0727]	[0.0760]	[0.0463]	[0.00683]	[0.00162]
Prov GDP per capita (in 2009)	-3.22e-05	-6.17e-05**	3.57e-05*	2.24e-05	-2.89e-06**	-4.94e-06***
	[3.75e-05]	[2.39e-05]	[1.70e-05]	[1.78e-05]	[8.38e-07]	[1.23e-06]
Constant	-0.856	0.405	-1.645**	-1.554***	0.438***	0.540***
	[0.574]	[0.499]	[0.593]	[0.406]	[0.0207]	[0.0345]
Observations	1,123	899	1,139	907	1,074	865
R-squared	0.034	0.103	0.035	0.132	0.103	0.096
Number of IDind	722	604	728	606	702	589

Note: Robust standard errors clustered in provincial level in brackets. *** p<0.01, ** p<0.05, * p<0.1 Layoff rate and financial loss are recent 3-year average at provincial level. Other controls include number of children in households, number of extra household members (number of household members-number of children-number of parents), and CPI adjusted GDP per capita in province. A constant is included. The sample consists of children in the state sector and non-state sector with the exclusion of collective sector from 1997 to 2004 for 7 provinces in CHNS dataset. Estimated for rural and urban sample separately.

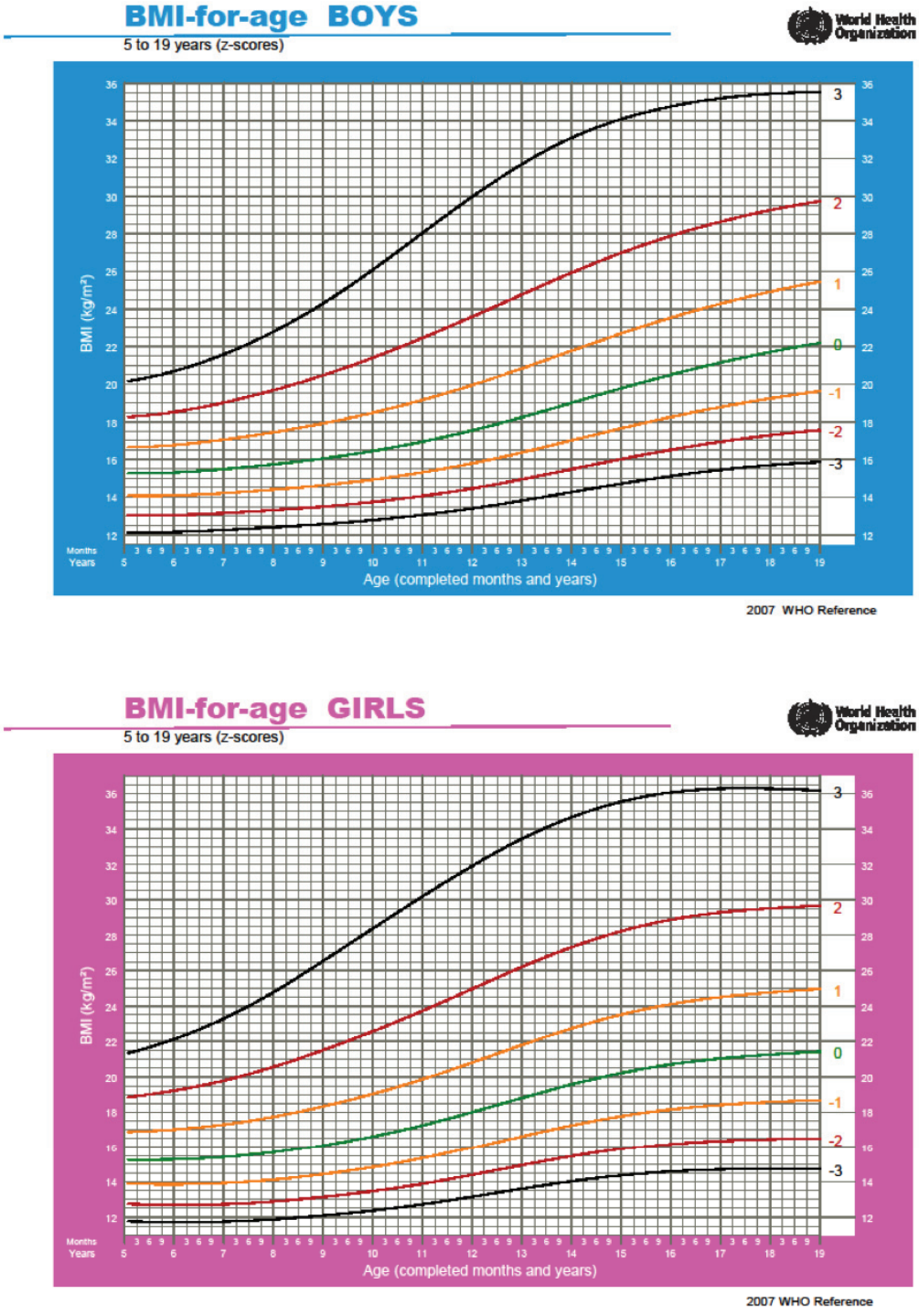
Results are highly consistent after including time trend, secondary school enrolment rate, birth rate, employment in non-state, population, and urban disposable income (in 2009 yuan)

Figure 3.1: Child capacity as a function of parental economic insecurity for different levels of expected economic loss.



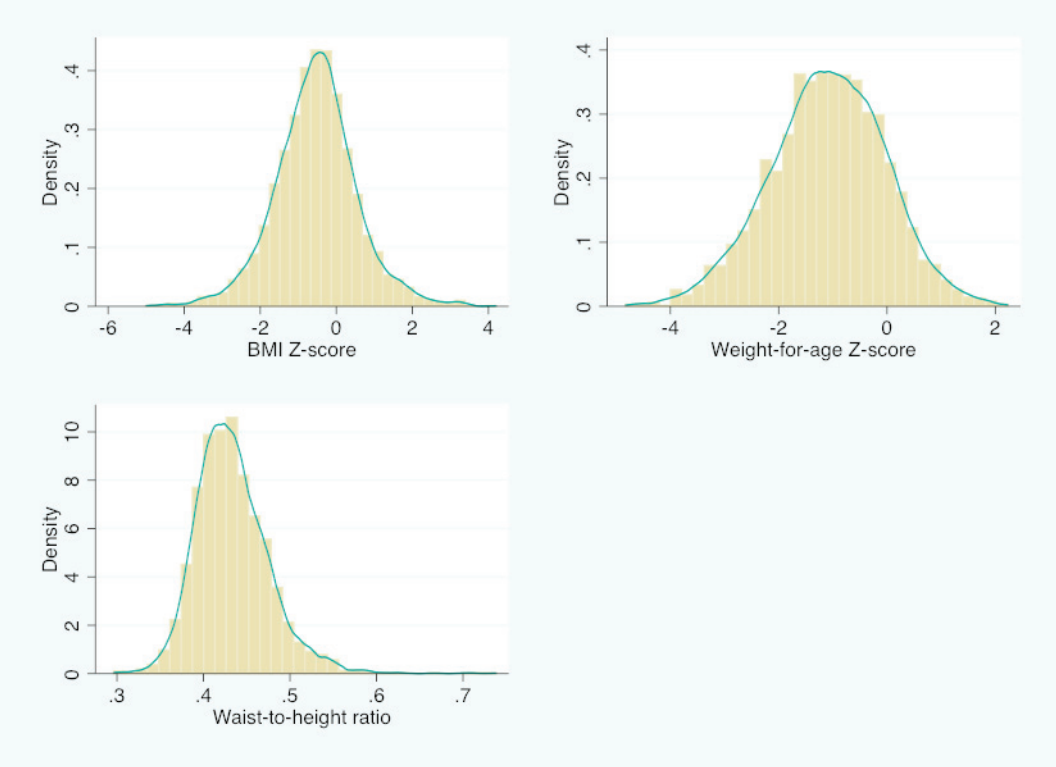
Note: Figure 1 presents the child's human capital formation as a function of parental economic insecurity. Group 1 is experience no change in economic insecurity. Group 2 experiences a mild increase in economic insecurity. Group 3 experiences a high increase in economic insecurity.

Figure 3.2: BMI growth charts for 5 to 19-year-olds from the World Health Organization.



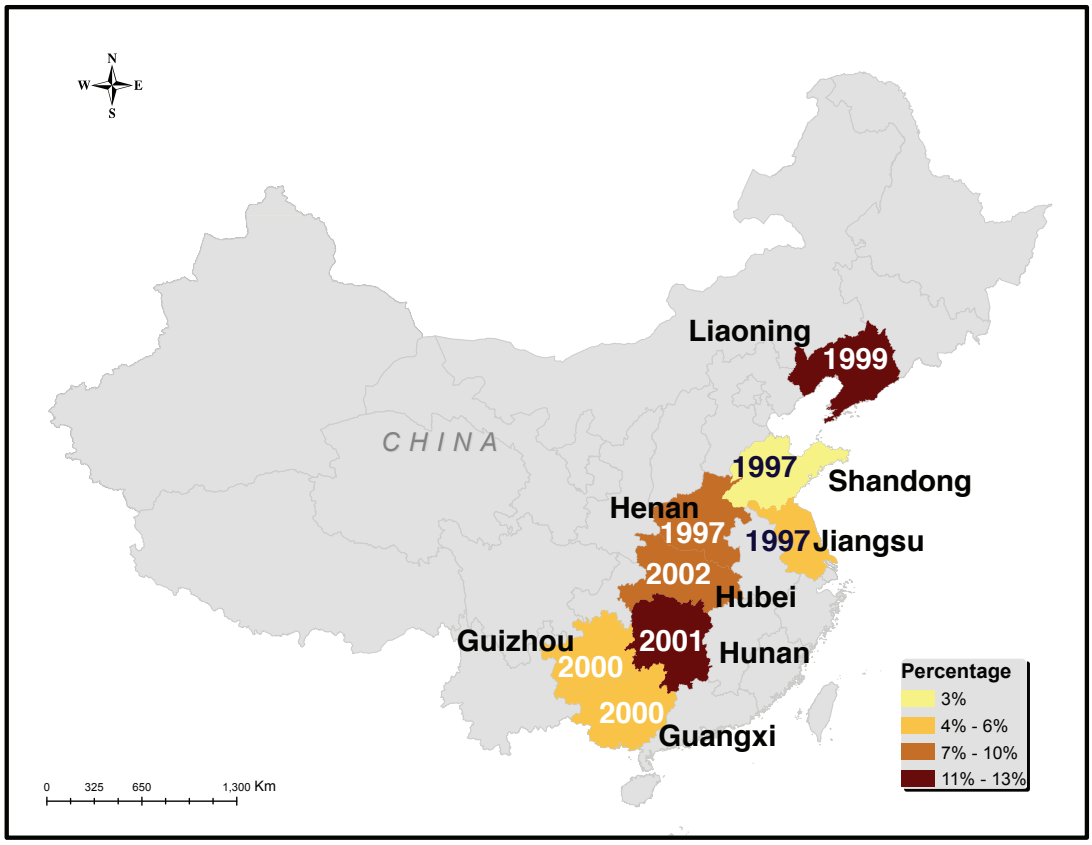
Source: http://www.who.int/growthref/

Figure 3.3: Density distribution of child outcomes in the CHNS sample.



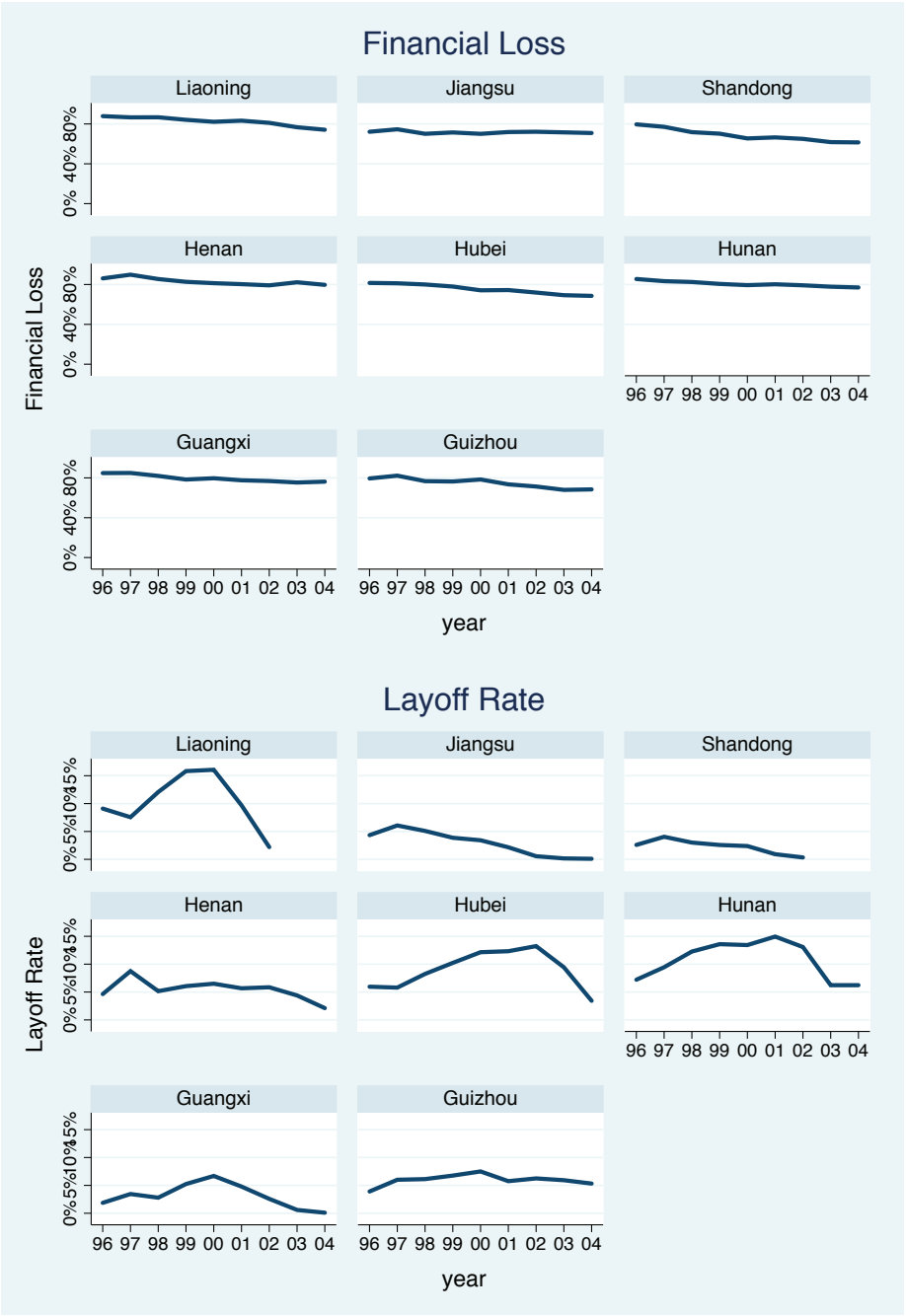
Note: The sample consists of families with children in the state sector and non-state sector with the exclusion of collective sector from 1997 to 2004 for 7 provinces in CHNS dataset. The blue lines in BMIZ-score, weight for height Z-score, and waist to height ratio show kernel density plots.

Figure 3.4: Expected economic loss by layoff policy peak year in CHNS provinces.



Data source: China Labour Statistics Yearbook.
Note: Expected economic loss in state sector is defined as provincial layoff rate times average financial loss from layoffs.

Figure 3.5: Level of economic insecurity by province and year, decomposed.

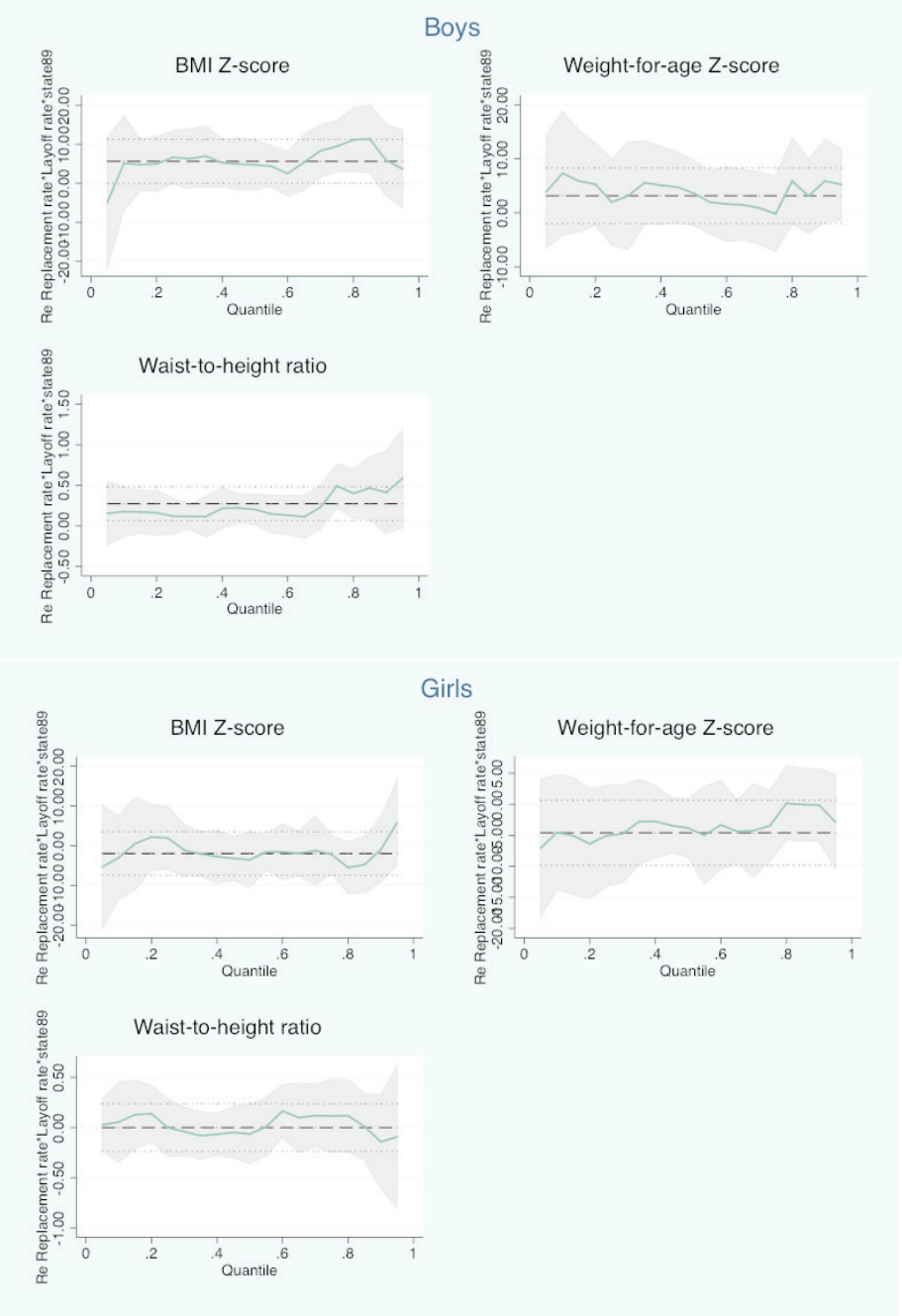


Data source: China Labour Statistics Yearbook.
The layoff rate is defined as the number of state sector laid off workers at year end divided by the number of state sector workers at the year end. Annual financial loss is defined as one minus the off-post state sector worker living subsidy divided by average salary of on post state sector workers at provincial level.

Figure 3.6: Parallel trend in child outcomes: State sector V.S. Non-state sector.

Note: The sample consists of all families with 0 to 19-year-old children in the state sector and non-state sector with the exclusion of collective sector from 1991 to 2006 for 7 provinces in CHNS dataset. The solid line represents the average of the outcome in the state sector; the grey area represents its 95% CI. The dash represents non-state sector, and its shaded area indicates the 95% CI. For all four outcomes, the state sector and the non-state sector present the same trend before the reform. The trends diverge during the reform, and converge after the reform.

Figure 3.7: The coefficient of $EconomicLoss \cdot Layoff \cdot state$ on children's BMI Z-score, Weight-for-age Z-score, Waist-to-height ratio over quantiles.



Note: The blue line indicates the coefficient of $EconomicLoss \cdot Layoff \cdot state$ on the vertical axis with the corresponding quantile on the horizontal axis. The 95% CI is shown in the shaded area. The coefficient and 95% CI in OLS are shown as the horizontal lines.

Chapter 4

Gender Bias Within Chinese Families—Who Eats First in Tough Times?

"Food consumption in particular has been shown to serve as a symbol or a code, describing certain human relationships, such as inclusion and exclusion, and intimacy and distance. Eating may also tell us about ourselves for eating is a rutted habituation that is so close to the core of our memories, to the formation of our character and the launching of our conscious experience, that its substances may be said to become a part of us."

—Bernadine Chee, 2000

4.1 Introduction

This chapter investigates the intra-household effects of negative income shocks on nutrition intakes of Chinese boys versus girls; mothers versus fathers; and children versus parents. Specifically, when an income loss occurs, whose food intake decreases most?

China has a long history of privileging male children. Parents treat the food their sons eat as a reflection of their improved economic status of the family, and no other mode of parent-child interaction communicates their love for their sons more than food (Jing, 2000). Many families, especially in rural areas, still treat sons as their own family members, while daughters will eventually be "married off", and leave the families. Therefore, it is common for parents to allocate income and resources from the daughter to son, especially when under a negative income shock when resources become scarce. Furthermore, sons are expected to support the parents when parents enter old age, especially in rural China. According to the China National Bureau of Statistics data in 2005, pensions cover 4.6% of elderly support in the rural area, while family support accounts for 54.1% (Dorfman et al., 2013). The majority of the old-age support is from private resources. Parents have the

incentive to invest in sons, thus directly investing in their future pension. Son-priority could also be explained by the gender imbalance and the high competition faced by boys. The marriage rate of men in China is positively correlated with socioeconomic status, and females are equally likely to get married regardless of their socioeconomic status. Parents therefore are more likely to have higher expectations on their sons' performance and thus will allocate more food to their sons.

This chapter fills three areas that are understudied in the literature. First, it is well-established that economic stress causes obesity (e.g. Smith, 2009; Offer, Pechey, & Ulijaszek, 2010; Rohde, Tang, & Osberg, 2017; Watson, Osberg, & Phipps, 2016) but the channel of the weight-gain is unclear. This chapter examines the dietary changes under economic stress, which contributes to the relationship between obesity and economic conditions. Second, the existence of intra-household inequality is acknowledged as a problem in all societies, but few studies have investigated it due to the scarcity of data on resource allocation within households. This chapter uses food intake, which is one of the most important kinds of resource in Chinese culture (Chee, 2000), to infer the inequality between boys and girls, fathers and mothers, and parents and children. Third, the effects of economic anxiety on health outcomes are mainly focused on adults, and little attention has been paid to children (except for Kong & Phipps, 2016). I investigate the effects of negative income shock on not only adults but also on the children. The finding has strong policy implications, as it suggests that families switch from the primary resource (protein) to an inferior resource (carbohydrate), which could affect children's development.

Novelties of this study include the following: 1) This chapter provides the rare examination, if not the first, of full range of family dynamics in intra-household allocation of a scarce resource. 2) It observes 32,44 groups of siblings of mixed-sex in the same families as well as their parents in 12 provinces from 1991 to 2011 and followed them up to 5 times. 3) Son and daughter pairs within the households are compared to infer intra-household resource allocation. 4) The daily intakes of macronutrients, summarized into protein, carbohydrates, fat and energy categories, are recorded respectively for both siblings and their parents. The categories of nutrition intake shed light on not only the quantity but also the quality of the

resource allocation. 5) The level of daily intake is adjusted for age- and gender-specific international standards.

The main purpose of the study is to investigate the gender inequality within households using nutrition distribution. It enriches the literature that examines the changes in nutrition intakes in response to a negative income shock within the household, as well as documents the macronutrient intakes of Chinese children and their parents, especially compared to international standards.

4.2 Related literature

The study of inequality often neglects inequality among household members (Burton, Phipps, & Woolley, 2007). Equal sharing of income, consumption, resource and well-being within the household is commonly assumed. However, a growing number of studies point out the importance of intra-household allocation. For example, Phipps and Burton (1995) discover that individual well-being is sensitive to income-sharing assumptions. Lise and Seitz (2011) estimates that the Gini coefficient could increase by 30% after accounting for consumption inequality within U.K. households.

Even if the existence of household inequality is recognized, the study of intra-household inequality is largely restrained by the data availability as the income is usually collected at household level (Osberg, 2000). Researchers have adopted different dimensions such as time, consumption, health and satisfaction to estimate the inequality within the household. For example, Burton, Phipps, and Woolley (2007) include home production in income inequality. Phipps, Burton, and Osberg (2001) demonstrate the inequality of free time for self among dual-earner households, and women are more likely stressed about weekly hours, despite the total hours of labour supply. Osberg (2015b) uses self-reported food deprivation in Tanzania and finds the elderly rural women are more likely to suffer from hunger. He highlights the gendered intra-household inequality and the demonstrates the importance of including such inequality into poverty measurements and pension designs.

Apart from inequality between spouses in the household, intra-household inequality also exists between parents and children, as well as sons and daughters. Lundberg, Pollak, and Wales (1997) shows an increase in children's clothing expenditure

if the family allowance is directly paid to mothers. Burton, Phipps, and Woolley (2007) use the age difference between couples in the eligibility of receiving the Old Age Security in Canada, and the result suggests that the increase in women's income leads to a larger expenditure on gifts (possibly to grandchildren). Haddad and Hoddinott (1994) uses data from Cote D'Ivoire and discover that an increase in women's cash income leads to an increase in boys' height-for-age relative to girls'. Duflo (2000) uses the expansion of the Old Age Pension program in South Africa and finds an improvement in girls' health and nutrition. To my knowledge, most research on intra-household inequality uses exogenous increases in income to investigate the resource allocation. Few studies have been done using an income fall.

I am particularly interested in food intake for three reasons. First, nutrition during childhood has long-term effects on the development of cognitive skills and the productivity later in life (e.g. Dasgupta, 1995). Such effects are particularly important in developing countries (Duflo, 2000). Second, Chinese culture is highly food-oriented (Chang, 1977), and food serves as a symbolic value of love. The process of deciding which foods to eat, who will eat them, and how much to eat provides a path to understanding their everyday lives, and draws a vital picture of their relationship with other people. The food allocation shapes the family dynamics between parents and children, sons and daughters, reflecting the pleasures and pressure of family members (Chang, 1977),.

Third, people of different cultures, geographies, and ethnicities eat different food and have different ways to prepare and cook food. For example, southern Chinese people tend to eat rice and favour sweet flavours, while northern Chinese cuisine features wheat and a salty flavour. Western Chinese cuisine serves hot and spicy meat based dishes. The differences in the food items, flavour, and cooking methods can all be measured in calories, carbohydrates, proteins, and fats. Such measures make them comparable resource indicators across culture, ethnicity, and economic status and over time[1].

[1]In the fixed effects estimation, I examine the changes in macronutrient intakes are examined within the same household. Energy, carbohydrate, protein, and fat intakes provide comparable measures of resource allocation.

Despite the emphasis on food in Chinese culture, only a few studies have examined food intake in China. For example, Jing (2000) adopts a sociology perspective and conducts case studies in municipalities such as Beijing and Xi'an to portray the changes in food intake under the rapid socioeconomic development of China. Chang (1977) examines the evolution of food culture over the history of five thousand years. The only quantitative research has been done focused on child food intake in contemporary China at a national level is Cui and Dibley (2012). They present the trend of dietary intake of Chinese children aged 7 to 17 using the China Health and Nutrition Survey (CHNS) data. They show a steady decline in energy and carbohydrate intake, and a steady increase in fat intake from 1991 to 2009. The value of daily protein intake decreases, but the ratio of protein-energy ratio increases slightly. However, Cui and Dibley (2012) mainly focus on the nutrition transition to a fat diet, and do not examine the income changes, sibling disparity, and parent-child interactions.

Past literature has linked stress with changes in eating behaviour. Smith (2009), Offer et al. (2010) and Köster and Mojet (2015), among other studies, describe food that is high in fat and carbohydrates as comfort food, and is served as self-medication; providing immediate relief from negative emotions. In other cases, Macht (2008), Köster and Mojet (2015), and Staudigel (2016) discover that stress could also reduce appetite and food intake. The bi-directional effects of emotion show that stress controls, suppresses, impairs, regulates, or harmonizes eating behaviour. On average, Macht (2008) shows that emotional stress induces 30% people to increase while 48% people to decrease in food intake using survey data. Staudigel (2016) uses Russian panel data and demonstrates economic insecurity reduces women's body weight. He also discovers a strong link between economic insecurity and sugar consumption.

In the Chinese context, Liu et al. (2007) examines the relationship between types of food consumed by college students in seven cities and their stress and depression measures. They find that the consumption of ready-to-go food (such as instant noodles, frozen, canned or microwavable foods), snack foods (such as potato chips, corn chips and tortilla chips) and fast food (such as McDonald's, KFC, Pizza Hut) is positively correlated with perceived stress level depression scores. They do not

establish the causal relationship between stress and eating behaviour. No research thus far examines the intergenerational dietary change resulted from economic stress. This chapter is also the first study in Chinese context to examine the dietary change of parents and children in response to an economic shock.

4.3 Data

4.3.1 The CHNS dietary intake data

The data of analysis are from the China Health and Nutrition Survey (CHNS) from 1991 to 2011 (eight cycles). The CHNS is the only large-scale longitudinal data set (Popkin et al., 2010) conducted by the Carolina Population Center at the University of North Carolina at Chapel Hill and the National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention. It covers 12 provinces that vary in geography, demographics and socioeconomic development (China Health and Nutrition Survey, 2017). Figure 4.1 presents the provinces that are covered by the CHNS data. Within each province, the sample is stratified by one low-, two middle- and one high- per-capita income county or city. The township capital and three villages in the county or the urban and suburban areas in the city are randomly selected. Twenty households are then randomly selected for the survey. All household members are interviewed. Children younger than 10 years old are assisted by parents. Community, household, and individual level data are collected. The CHNS is representative of more than half of the population in China. There are 12,944 households and 16,066 children in the 1991 cycle. In 2011, there are 15,508 households and 22,977 children in the survey.

The CHNS hosts several features that make it particularly attractive for this study. First, the longitudinal nature of the data enables me to observe families for up to 14 years [2] During the 14 years, the rapid economic development accompanied by the economic reforms takes place and creates a rare opportunity to study negative income shocks. In the data 11.6% of the sample, which amounts to 646 children, experience large negative income shocks (defined as 25% of income loss). Second, the CHNS not only provides information on the household heads, but also every

[2]The CHNS panel runs from 1991 to 2011. The number of occurrences is also restrained by the age of the child in the sample (2 to 17 years).

household member, including fathers, mothers, sons and daughters. The ability to identify the relationship of household members enables studies on intra-household dynamics and inequality. Third, the wide range of survey sample of 12 provinces with both urban and rural areas enables me to observe 3,244 families with children of mixed-sex, which is a rare find in China under the One Child Policy. Fourth, the CHNS collects dietary intake information of all household members over the course of three days. The collection of dietary intakes is on a 24-hour-recall basis, and employs strict measures of changes in food stock, making the data quality objective and precise. The detailed information of dietary intake data collection and calculation is the following:

Food intake is measured at the household level as well the individual level (i.e. both children and parents) over three consecutive days of the survey. The three survey days are randomly distributed across seven days of a week. The household level of food intake is calculated by the change in food inventory from the beginning to the end of each day. It is measured with a weighing and measuring technique using Chinese balance scale ranging from 20 grams (*1 liang*) to 15 kilograms (*30 jin*). The nutritionists measure all the food items before the initiation of a 3-day survey period (a_0), all purchases and home production (a_1) during the survey period, and the food discarded and remaining food at the end of each day (a_2). The food consumption of household level is therefore defined as $a_0 + a_1 - a_2$.

Every household member reports all food consumed at home and away from home on a 24-hour recall basis[3]. Mothers or caregivers who handle food preparation are asked to recall the food consumption of children younger than 12 years old. Nutritionists record the types of food and snacks, the method of cooking, as well as the time and place of consumption. Mothers, or those who handle the food preparations, together with other household members provide information on shared dishes to determine the amount of individual intake. More than 99% survey respondents have reported full three days of data (China Health and Nutrition Survey, 2017).

[3]According to the CHNS, 12% breakfast, 11% lunch and 5% dinner are consumed away from home. Home cooking accounts for 70% to 80% during the three-day survey period.

To calculate the daily intake of macronutrients including carbohydrates, fat, protein, and energy, the 1991 Food Composition Table for China is used as an average amount on a dish-by-dish basis for survey cycles prior to 2004. The 2002 Food Composition Table is used in the subsequent surveys cycles of 2004, 2006, 2009 and 2011.

The CHNS implements strict quality control procedures. It follows the Declaration of Helsinki, and the survey protocols, instruments, and process are approved by the institutional review committees of the University of North Carolina at Chapel Hill. The written consent was obtained from all survey respondents. The food intake at the household level is matched with the individual level data. If a significant discrepancy is found between the sum of individual level data and the household data, the CHNS revisits the family to resolve the inconsistency. Field workers are trained nutritionists who have post-secondary degrees and professional work experience in nutrition. The CHNS also provides three days of training on dietary data collection to the field workers before the survey (China Health and Nutrition Survey, 2017).

4.3.2 Dietary Reference Intakes (DRIs)

I use the Dietary Reference Intakes (DRIs)[4] to adjust for the nutrient needs according to the growth of children and the gender- and age-specific requirements for parents (see Table 4.1). The DRIs table is developed by the Institute of Medicine at the National Academies of Sciences Engineering Medicine and is widely used in many international studies including the U.S. Guidelines for Americans, National Health and Nutrition Examination Survey and the Canadian Community Health Survey. It provides guidelines in daily consumption of energy, carbohydrate, protein and fat intakes for 97% to 98% of healthy individuals to meet nutrient requirements. The values are based on the recommended Physical Activity Level (PLA) of 1.6 to 1.7 in healthy individuals, which means the total energy consumption is 60% to 70% of the resting energy expenditure, and it is equivalent of 60 minutes of daily physical activity (Trumbo et al., 2002). The DRIs also take into account

[4]There are other food intake standards, such as the adult equivalence scale of food energy intake as adopted in Osberg (2015b). The advantage of the DRIs standards is that it provides not only the overall calorie intakes but also the protein, carbohydrate, and fat intakes.

pregnant and lactating women, as these special stages require higher levels of nutrition intake. The adjustments are used when the analysis is done for children's mothers in the later section.
The dependent variable is children or parents' percentage deviation in macronutrient intakes from the DRIs in the age- and gender-specific group[5].

$$IntakeDev_i = (Intake_i - DRIs)/DRIs \tag{4.1}$$

Table 4.2 shows summary statistics using the pooled sibling sample (with and without negative income shocks). A high-carbohydrate and low-protein diet is found in boys, girls, fathers and mothers. For example, the carbohydrate intake is 152.9% for boys and 138.7% for girls relative to the DRIs standards, while the protein intake is only 70.3% for boys and 59.7% for girls. This result is consistent with previous findings of lower protein-energy ratios in developing countries (Millward & Jackson, 2003). The overall energy intake is 110.7% for boys and 99.8% for girls. The fat intakes are 60.2% for boys and 51.5% for girls.
In all macronutrient categories, consistently lower intakes of girls are observed compared to boys in the same families with gaps ranging from 9 to 15 percentage points. Their parents' nutrition intakes exhibit the similar patterns as the children. On average, fathers of boys' energy intake is 169.3% while mothers of boys' intake is 143.5%. The discrepancy highlights gender differences in dietary intakes among parents.
Table 4.2 also validates the sample of selection for boys and girls. Statistically identical results are shown between the parents of girls and the parents of boys. For example, when comparing the energy intake for mothers of boys to mothers' of girls, the average is 143.5% for both. The result suggests that the girls and boys are selected from the statistically identical sample.

4.3.3 Negative income shock and its reasons

Hacker et al. (2014) propose the "Economic Security Index" using the frequency of a 25% decline in individual net CPI-adjusted income from one year to the next.

[5]The raw intakes are trimmed so that the observations above the top and below bottom 1% are equal to the top and the bottom 1% respectively.

I adopt this criterion of a "large" income shock and define the negative income shocks as the equivalent income loss (from all sources) more than 25% of the average of most recent three income observed[6].

$$
\begin{aligned}
NegShock_{it} &= 0 \qquad \text{if } \frac{Y_{it} - \bar{Y}_i}{\bar{Y}_i} > -0.25; \\
NegShock_{it} &= 1 \qquad \text{if } \frac{Y_{it} - \bar{Y}_i}{\bar{Y}_i} \leq -0.25
\end{aligned} \tag{4.2}
$$

where Y_{it} is equivalent income of current cycle (i.e. family income from all sources divided by square root of household size); and $\bar{Y}_i = (Y_{it} + Y_{it-1} + Y_{it-2})/3$. Data are trimmed so that negative income is equal to zero. I ignore negative income because many families who are in business, farming, gardening, fishing, or raising livestock report negative income. The nature of such business is to invest for a few years and thus generating negative income, but a large return in the future is expected (China Health and Nutrition Survey, 2017).

Types of economic risks

Osberg (1998) outlines four aspects of economic risks identified in *the United Nations' Universal Declaration of Human Rights*: unemployment, illness, family dissolution, and old age. In the CHNS data, the four risks can be identified by the following questions:

- Unemployment: Changed or lost jobs since the last survey.
- Illness: Self-reported health of 1 or 2 on a 4-point scale, or self-reported hypertension, diabetes, myocardial diseases, stroke or cancer.
- Family dissolution: Single, divorced, widowed or separated.
- Old age: male older than 60 and female older than 55[7]

For simplicity, the child is coded in the category if either parent is in the category. Table 4.3 shows the percentage of children associated with each economic risk by

[6]The 25% income fall from the recent three-year average may lead to a larger income shock than from the previous year. I also examine the 25% income loss from the previous year and the results are highly consistent.

[7]The average retirement age in China is 60 for men and 55 for women (Dorfman et al., 2013).

families with or without a significant negative income shock (25% of equivalent income loss). For children who experience a negative income shock in the family, 35% experience illness of parents, 17% have unemployment, 3% have family breakups, and 0.3% have old aged parents. The families without negative income shock have a lower economic risk in each category except for old age.

Dietary knowledge

The CHNS also asks respondents 12-year and older diet knowledge in the cycles 2004, 2006, 2009 and 2011. To infer the overall energy intake, fat, carbohydrates, protein and body image, the five questions are selected: *Do you strongly agree (5), agree, neither agree nor disagree, disagree or strongly disagree (1) with the following statements:*

- *Eating a large amount of sugar is good for health.*
- *Eating food high in fat is good for health.*
- *Eating a large amount of staple food is good for health.*
- *Eating a large amount of animal products (e.g. fish, poultry, eggs, and lean pork) every day ia good for health.*
- *The heavier you are, the healthier you are.*

Table 4.3 shows the mean and standard deviation of each question answered by children in the families with and without negative income shock. Children experiencing a negative income shock rated higher for all questions compare to children without a negative income shock.

4.3.4 Child sample

The sample of this study consists of children of 2 to 17-year-old[8] in the survey years of 1991 to 2011. The birth cohort of the children is from 1973 to 2009. In

[8]Children and infants who are younger than 2-year-old are likely breastfed and the dietary intakes are thus incomparable.

the CHNS children sample, 36% of the children are from only-child families and 3,357 children have had one or more siblings of the opposite sex[9].

I limit the sample of analysis to families with one or more child of the opposite sex for sibling fixed effects analyses. At least one girl and one boy are observed in each family, and at least two children are observed in each family in each nutrition survey year. The sample consists of 3,243 children and 1,364 households, with 20% of children observed four times, 28% three times, and 34% twice in the longitudinal sample.

There are 2,667 boys and 2,908 girls in the sample (see Table 4.2). The average birth order for boys is 1.9 and for girls is 1.6. The difference is statistically significant, and it can be explained by the One Child Policy, which permits the second birth in rural area if the first child is a girl. Other demographic variables are consistent across genders. In the sample, 11.4% of boys and 11.8% of girls experience negative income shock (25% income decline than the average in recent three cycles). On average, the equivalent household income is 7325 CPI-adjusted-2006 Yuan. Rural children account for 81% of the sample. On average, there are 2.5 children and 2.5 extra household members in a family. In the sample of analysis. 33% of children have completed primary schooling, and 20% have completed middle schooling. 43% of the children reached the age of puberty.

4.3.5 Siblings under the One Child Policy

How does the sibling sample in this study compare with the only-child sample? Even under the China One Child Policy, siblings are still commonly observed in Chinese families. Culturally and historically, Chinese families are in favour for having more children. Mao Zedong, the chairman of China from 1949 to 1976, advocated "more people, more power" and believed a rising population is a major drive for economic growth. After Mao's death in 1976, Deng Xiaoping took power. Deng believed in population control and promoted the growth in GDP per capita. The Chinese government thus enacted the One Child Policy in 1979 (Peng, 1991).

[9]I also investigate if the first borns are favoured in families with children of the same sex. No significant patterns are found

The One Child Policy was resisted by Chinese families, especially in the rural areas. Starting in 1984 and 1985, the communist government relaxed the policy so that rural families with one daughter could have a second child. The fertility rate, therefore, rebounded from 1984 to 1986. Besides of the less stringent implementation in rural areas, the One Child Policy was also relatively relaxed in less developed provinces and ethnic minority groups. Figure4.2 shows the fertility rate in the urban and rural area from 1973 to 2009. The fertility rates were 5 and 2.4 in the rural and urban area respectively in 1973, and the figures became 1.4 and 0.96 in 2009. Therefore, for the birth cohort of this study from 1973 to 2009, it is common for Chinese families to have siblings.

Figure 4.3 presents mean and standard errors of percentage deviation of children's and parents' macro-nutrient intake from the DRIs standards by gender and only-child status. Protein intakes of Chinese children in all groups are significantly lower than the international standard. Boys have more protein than girls in both only child and non-only-child families. On average, Chinese boys in non-only-child families have 79% of the protein, comparing to Chinese girls in non-only-child families having 68% of the protein using DRIs standards. In only-child-families, the protein intake is higher for both genders—83% for boys and 76% for girls. Fat intake shows the same pattern as the protein intake with a smaller gap from the DRIs standards. On the contrary, carbohydrate intakes of Chinese children are relatively high, especially in non-only-child families. Boys with siblings consume 130% and girls with siblings consume 120% of carbohydrates intake standard. Carbohydrate intakes are 107% and 76% of the DRIs standards for only-child boys and girls respectively. The total energy intake is highest among boys with siblings, and lowest among only-child girls.

The shortage of protein intake and excess of carbohydrate intake are even more prominent among parents. Fathers' protein intakes range from 36% to 41% of the international standard, while father's carbohydrate intake is 1.7 to 2.4 times of the international standard. Mothers, on average, consume 48% of protein, and 1.7 times carbohydrates of the DRIs standards. Both mothers and fathers consume smaller amounts of fat in non-only-child families than those in only-child families,

but higher total energy intakes contributed by high carbohydrate intakes[10].

4.4 Empirical framework

4.4.1 Sibling fixed effect model

In economic literature, most studies on children estimate child outcomes on a set of observables of family and child characteristics. Two concerns are raised by this approach, unobserved heterogeneity and income endogeneity (Dahl & Lochner, 2012). Mayer (1997), among others, suggests that the estimation omits unobserved heterogeneities across households. For example, children's outcomes could be driven by factors (neighbourhood, family environment and child's ability) other than income. In the Chinese context, the One-Child Policy boosted gender selection practice using ultrasound technology since its introduction in the 1980s (Chen et al., 2013). The availability of gender-selected abortions differs across provinces, urban or rural, economic status and family values, which contributes to the selection bias of girls and boys families. It is possible that girls may be more likely from disadvantaged families because their families cannot afford ultrasound scanning or abortions.

To remove the permanent unobserved family and children characteristics, I use sibling fixed effects as adopted by Blau (1999) and Levy & Duncan (2000).. I estimate the differences in dietary intakes between brothers and sisters within the same households. Differences in family levels across siblings are removed when estimating the impacts of negative income shocks on child outcomes. The fixed effects model also enables me to compare the dietary intakes with and without negative income shock, and thus estimating the changes in dietary intakes in response to negative incomes. I employ three estimations on children, parents, and the combination of parent-children.

[10]I examine the intergenerational gender inequality among only-child families using propensity score matching, and found that the gender inequality is only significant among families with children of mixed-sex.

First, I estimate child dietary intakes with sibling fixed effects as follows:

$$IntakeDev_{ijt} = \alpha_j + \beta_0 NegShock_{jt} \cdot Girl_{ij} + \beta_1 NegShock_{jt} + \mathbf{\Gamma_1 X_{jt}} + \mathbf{\Gamma_2 W_{ijt}} + \epsilon_{ijt} \tag{4.3}$$

where i indexes individuals (i.e. children in this equation), j indexes families, and t indexes survey year. *IntakeDev* is percentage deviation of energy, carbohydrate, fat and protein intake from the age- and gender-specific Dietary Reference Intake standard. X is a vector of family-specific characteristics. W is a vector of observed child-specific characteristics. Standard errors are clustered at the family level.

The sibling fixed effects are captured by α_j, which reflect unobserved permanent family characteristics.The hypothesis is that $\beta_0 < 0$, which suggests in response to negative income shocks, girls reduce their macronutrient intakes more than boys in the same families.

Second, I examine the parents' dietary intakes using the same children's sample.

$$IntakeDev_{ijt} = \alpha_j + \beta_0 NegShock_{jt} \cdot Mother_{ij} + \beta_1 NegShock_{jt} + \mathbf{\Gamma_1 X_{jt}} + \mathbf{\Gamma_2 W_{ijt}} + \epsilon_{ijt} \tag{4.4}$$

where i indexes individuals (parent in this equation). $IntakeDev_{ijt}$ is percentage deviation of the father or the mother's energy, carbohydrate, fat or protein intake from the DRIs standards. $NegShock_{jt}$ estimates the overall effects of negative income shocks on both the father and the mother, and $NegShock_{jt} \cdot Mother_ij$ captures the extra effects on the mother in the same household.

Third, I combine the child sample and the parent sample estimated above, and test if parents shield their children from dietary reductions when economic hardships strike. By estimating the dietary intakes of two generations, I can investigate the resource reallocation among fathers, mothers, sons and daughters in the same households.

$$\begin{aligned} IntakeDev_{ijt} = \alpha_j &+ \beta_0 NegShock_{jt} \cdot Girl_{ij} \\ &+ \beta_1 NegShock_{jt} \cdot Mother_{ij} \\ &+ \beta_2 NegShock_{jt} \cdot Father_{ij} \\ &+ \beta_3 NegShock_{jt} + \mathbf{\Gamma_1 X_{jt}} + \mathbf{\Gamma_2 W_{ijt}} + \epsilon_{ijt} \end{aligned} \tag{4.5}$$

where i indexes family members. The base of $NegShock$ effects is boys, and the interaction terms of $NegShock$ with girls, mothers and fathers capture the extra effects on each individual.

4.4.2 Other controls

For all sibling fixed effects estimation, I present 3 specifications. First specification controls the number of children in the families, if there is/are grandparent(s) or relatives present. The second specification adds if the child graduated from primary school or middle school, the birth order of the child, and if the child entered puberty [11]. The last specification adds the log equivalent income of the current period[12].

Figure 4.4 shows the means and standard errors of independent variables by child gender and only-child status. There are 10% of non-only-child families in the pooled sample experiencing negative income shock, while only 6% of only-child families had negative income shock. The only-child and non-only child families differ in demographic characteristics. According to Figure 4.4, only-child families have more household members other than children and parents. There is a higher percentage of only-children who completed middle school than non-only children. Equivalent income is 7,738 for non-only-child families and 14,770 for only-child families. 80% non-only child families and 59% of the only-child families are in rural area.

4.5 Results

4.5.1 Boys and girls' intakes

Table 4.4 shows the estimates of child nutrition intake using sibling fixed effects. The hypothesis is that negative income shocks affect boys' intakes less than girls', i.e. sons are favoured during tough times. I examine three nutrition intakes, carbohydrates, fat and protein, as well as the overall energy intakes (the combination of the three nutrition). For each outcome, I use three specifications: the first

[11]Girls entering puberty if the answer is "Yes" to the question "Have you ever menstruated?" and boys entering puberty is defined as at 11 to 18 (Zhu et al., 2013).

[12]Equivalent income is defined as household income from all sources after tax and transfer in 2006 *Yuan* divided by the square root of household size (Luxembourg Income Study, 2017).

one controls for time-variant household characteristics; the second one controls for household characteristics and child-specific characteristics; and the third specification adds the current equivalent income as control. While the variables of interests are negative income shock and its interaction(s), equivalent income in fixed effects model also captures the changes in income. Therefore, the second specification is the preferred specification. The income variable is added in the third specification to estimate the "extra" critical point effects of 25% income fall.

Column 1 in Table 4.4 shows energy intake of children increases in response to a negative income shock, controlling for family characteristics. A 25% of income shock increases energy intake by 9.9 percentage points in terms of the DRIs standards. After accounting for household and child characteristics, the interaction of negative shock and girl becomes significant. Girls reduce their energy intake by 7 percentage points, while boys' energy is not significantly affected.

Carbohydrate intake is also significantly affected by negative income shocks. Column 4 shows that carbohydrate intake increases by 21.3 percentage points for boys, and by 13.9 (=0.213-0.074) percentage points for girls. After controlling for child-specific characteristics, the estimation still shows a 12.4-percentage-point increase in boys, but a 2.4-percentage-point decrease in girls. In the preferred specification in Column 6, a 14-percentage-point increase in boys, and a 0.5-percentage-point decrease in girls is estimated after controlling for income.

The sibling fixed effects estimation shows that protein intake reduces for both girls and boys when income falls 25% (see Columns 10-12, Table 4.4). With controls for families observed and permanent unobserved characteristics, boys' protein intakes decrease by 15.2 percentage points, and girls' protein intakes decrease by 24.9 percentage points. The magnitude of reductions is significant considering the average of protein intake is only 70.3% of DRIs standard for boys and 59.7% for girls. The results persist even after controlling for income. There is a 16-percentage-point decrease for protein intake for all children. The interaction term of negative shock and girl becomes insignificant.

On the contrary to the previous finding of a positive relationship between fat diet and economic insecurity, no change in fat intake of children is found due to negative income shocks.

Sample of adolescents

Adolescence is a critical transition period, and many biological, psychological and social roles are formed during this life stage. It is the foundation of future development (Sawyer et al., 2012). I limit the sample to adolescents and test if the gender disparity is larger during this life period. The adolescent sample is defined as girls from menstruation to 17-year-old and boys from 11-year old until 17-year-old (World Health Organization, 2017). There are 1,391 boys and 1,005 girls in the adolescent sample, which accounts for 43% of the full sibling sample[13].

Table 4.5 presents the sibling fixed effects estimates of dietary intakes on negative income shocks. Columns 1 to 3 show that daily energy intake is significantly reduced by 18.2 to 21.1 percentage points in the presence of negative income shocks for girls, while no reduction of energy intakes for boys. This result is consistent across three specifications. This result suggests a higher gender disparity among adolescents than the previous estimate with full sibling sample.

Girls also experience a large decrease in carbohydrate intake. After controlling for household and child-specific characteristics, the carbohydrate intake decreases by 29.4 percentage points for girls. Boys, on the contrary, is estimated a 24.4-percentage-point increase in carbohydrate intake in Column 6. After controlling for income, girls still experience a 5-percentage-point of carbohydrate intake reduction, which is a 29.4-percentage-point difference between boys and girls. This result suggests that the boys eat more and the girls reduce their carbohydrate intakes in response to a negative income shock.

Negative income shocks have negative effects on the fat intake of adolescent girls. Columns 7 to 9 in Table 4.5 show the fat intake reduces by 18.2 to 20.1 percentage points for girls. Boys fat intake show no significant change. The average fat intake for girls is only 51.5% of the DRIs standard, while for boys is 60.2% (see Table 4.2). The reduction in fat intake due to the negative income shock puts adolescent girls in a more disadvantaged diet than their boy counterparts.

The protein intake is estimated to be negatively affected by income shock for both

[13]I also examine the early childhood sample of 2-to-5-year-olds, as Heckman (2011) outlines the importance of invest in the early years. I do not find a significant gender disparity in the sample of early years.

genders (see Column 10 in Table 4.5). Boys' protein intake is estimated to be reduced by 11.0 percentage points, while girls are expected to reduce a further 8.5% in protein intake, totalling 19.5-percentage-point reduction. The effects on both girls and boys become insignificant after controlling for income.
Overall, the estimates of the adolescent sample show a larger gender disparity between boys and girls within the household. In response to negative income shock, girls in the adolescent sample intake 19.3 percentage points less of energy, 29.4 less of carbohydrate, and 19.6 less of fat, compared to boys in the same households. Considering girls have lower intakes than boys using the DRIs standards, the dietary reductions from the income loss is particularly problematic.

4.5.2 Fathers' and mothers' intakes

Table 4.6 presents the estimates of parents' dietary intakes with family fixed effects. The hypothesis is that mothers take a larger dietary cut than fathers in response to negative income shocks. The differential effects of negative income shock between mothers and fathers are captured by $NegShock \cdot Mother$.
Columns 1 to 9 show negative coefficients of $NegShock \cdot Mother$, which means mothers reduce energy, carbohydrate, and fat intakes significantly more than fathers. The estimates are highly consistent across three specifications. Compared to fathers, mothers reduce 29 to 31 percentage points more in energy, 47 to 50 percentage points more in carbohydrates, and 25 to 27 percentage points more in fat intakes in response to negative income shocks. The only exception is protein intake. On average, a 6.02-percentage-point reduction is found in fathers protein intake, while a 1.75 (=-0.0602+0.0427)-percentage-point reduction in mothers' protein intake. There is no evidence of significant reduction in father's dietary intakes except for protein intakes. On the contrary, an increase in carbohydrate intakes of 12.6 to 19.1 percentage points is found in specifications 1 and 2 (see Columns 4 and 5 in Table 4.6)

4.5.3 Parents' and children's intakes

Table 4.7 presents the family fixed effects estimates of both parents and children using the same sample of siblings of mixed-sex. The coefficient of $NegShock$ is the

overall effects of negative income shocks on the family, and the interactions are the extra effects on girls, mothers and fathers using boys as the base.

The results are mostly consistent across three specifications. For simplicity, I use specification 2 for result interpretations. Negative income shocks significantly reduce energy, carbohydrate, and protein intakes of boys. Fathers experience increases in energy, carbohydrate intakes. Girls reduce energy, carbohydrate, fat and protein intakes more than boys in the same families. The gaps of the macronutrient intakes between boys and girls are 11.3 percentage points in energy and 17.5 percentage points in carbohydrates, 7.63 percentage points in fat, and 6.01 percentage points in protein. Mothers in the same families reduce intakes the most. On average, mothers reduce additional 14.0 percentage points in energy, 18.6 percentage points in carbohydrates, and 18.4 percentage points in protein intakes to the sons' dietary reduction.

Figure 4.5 presents the energy intake allocation with and without negative income shock. I use the mean of the sample and the estimates from Column 2 in Table 4.7 to calculate the percentage deviations of energy intakes with and without negative income shocks. The percentage deviation of energy intake from DRIs standard is labelled. The energy intakes show a 3-percentage-point increase for fathers, a 7-percentage-point decrease for sons, a 19-percentage-point decrease for daughters, and a 22-percentage-point decrease for mothers.

To interpret the results more intuitively, I convert the percentage-point of energy reduction into the rice consumption using the United States Department of Agriculture Food Composition Database. On average, a 22-percentage-point decrease in energy intake for mothers means a 166.6-gram daily reduction in cooked rice. A 19-percentage-point decrease for daughters is equivalent to a 134.7-gram rice reduction. A 7-percentage-point decrease for sons reduces rice consumption by 49.9 grams.

The estimates of Table 4.7 highlight the order of resource redistribution in the event of income shocks: macronutrients allocate to fathers first, sons second, daughters third, and the mothers last. Fathers, as the main bread earners of families, are likely to be supported first to ensure future income. Although it is not officially

documented by the CHNS, mothers or housewives are usually the main food handlers in the family. The largest reduction in mothers are likely to be explained by the altruistic sacrifice towards their children.

4.6 Robustness check

The specifications so far assume that the negative income shock takes effects at a 25% threshold. However, Osberg (2015a) argues that the 25% cut is a rather arbitrary threshold. I, therefore, test the income loss of 20% and 30%. The results are consistent. I also test the estimation by using a continuous measure of income loss. Instead of using a binary variable of negative income shock, the proportionate income loss is used and it is defined as the following:

$$\begin{aligned} IncomeFall_{it} &= \frac{Y_{it} - Y_{it-1}}{Y_{it-1}} && \text{if } Y_{it} \leq Y_{it-1}; \\ IncomeFall_{it} &= 0 && \text{if } Y_{it} > Y_{it-1} \end{aligned} \tag{4.6}$$

Table 4.8 shows the sibling fixed effects estimates of dietary intake using the continuous measures. To be comparable with the previous estimation, it starts with simple specification and gradually adds more controls. Specification 1 controls for household characteristics. Specification 2 adds child characteristics, and Specification 3 controls for all including log equivalent income. All specifications estimate for percentage deviation of energy, carbohydrate, fat and protein intakes from the DRIs standard.

Column 1 in Table 4.8 shows that when income falls by one percentage point, the energy intake increases by 0.12 percentage points of the DRIs standard controlling for household characteristics. The girls' daily intake of overall energy is 0.08 percentage points lower than boys. The effects of income fall become stronger after controlling for child-specific characteristics and income. Column 3 shows that one percentage point in income fall from the previous cycle, boys increases energy intake by 0.23 percentage points. Alternatively, a one standard deviation increase in income fall leads to a 9.2% of standard deviations increase in energy intake[14].

[14]It is calculated using the coefficient multiplied by the standard deviation of income fall, divided by the standard deviation of the dependent variable.

Girls' energy intake is significantly lower than boys. For one standard deviation of income fall, girls energy intake increase by 2.9%.

Columns 3 to 12 in Table 4.8 break down the energy intake into types of macronutrient. The estimates of carbohydrate in three specifications show consistent positive effects from income fall as shown in row 2. *%IncomeFall* is positive, meaning the income fall increases carbohydrate intake, and *%IncomeFall*Girl* is negative, meaning the effects on carbohydrate intake is negative on girls compared to their brothers. The preferred specification of Column 6 shows that a 100% income fall increases carbohydrate intake by 42.1 percentage points for boys, and 15.3 percentage points (=0.42.1-0.268) in girls. In other words, one standard deviation decrease in income, increases carbohydrate intake by 11.3% standard deviations in boys, and 4.1% standard deviations in girls. Fat intakes are not statistically significant. Protein intake is reduced in both genders, with a larger reduction in girls. A unit of income fall leads to a reduction of protein intake by 0.255 units of for boys, and by 0.378 (=-0.255-0.123) units for girls. If the income decreases by 1 standard deviation, the protein intake would decrease by 8.9% standard deviations for boys and 13.2% standard deviations for girls.

Table 4.9 shows larger effects of income fall using adolescents sample. For one unit of income fall, energy intake increases by 0.386 percentage points in boys, and 0.052 percentage points in girls; carbohydrate intake increases by 0.727 percentage points in boys, and 0.194 percentage points in girls. In other words, one standard deviation in income fall increase energy intake by 14.2% standard deviations in boys, and 1.9% standard deviations in girls, and increase carbohydrate intake by 19.0% in boys, and 5.0% in girls. Changes in fat and protein intake are insignificant in the adolescent sample.

The estimates using the percentage income fall show that children's food intake and nutrition allocation is affected by the level of income fall continuously. The average effects show that boys and girls increase the carbohydrate intake and decrease the protein intake in response to income losses. The increase in carbohydrate is less but the decrease in protein is more for girls.

I also test quadratic form of income loss. The quadratic term is not significant. Besides the sample of children with siblings of opposite sex, I examine the children

with siblings of the same sex. I do not find any dietary orders or patterns within the families, such as the first-born preference.

4.7 Conclusion

This study draws the following conclusions. First, protein and fat intakes of Chinese children are significantly lower, while carbohydrate and overall energy intakes are higher, than the DRIs standard. In all four categories, girls have significantly lower intake levels than boys, suggesting a gender disparity before the negative income shocks take place. Second, in response to negative income, Chinese families tend to reduce their protein intake, the primary macronutrient, possibly due to a higher price. Third, adolescent girls experience a larger dietary reduction than boys in energy, carbohydrate, and fat intakes.

The most compelling finding is that when families experience negative income shocks, the resource is allocated in the order of fathers, sons, daughters and mothers. Gender inequality is heightened in the event of income loss. The prioritizing fathers and sons, while neglecting daughters and mothers show an increase in gender disparity in response to large income loss. It draws concerns that economic losses are likely to impede the development of daughters and obstructs the well-being of mothers.

Birch and Fisher (1998) documents that eating behaviour during childhood and adolescence can have significant influences on future food intake. Parental dietary practices can alter dietary intake patterns, preferences for energy-dense foods, and even the internal responsiveness to hunger and satiety in children and in future adulthood. The phenomenon of "feeding the little emperor" in response to negative income shocks in Chinese families is especially problematic for children's future development, and could contribute to unhealthy eating habits and adult obesity.

It is unclear that the differences in dietary intake are caused by parental control, or if it stems from the children themselves. The gender difference could come from the children themselves. Sons could be more expressive about their demands than daughters. Girls, especially adolescent girls, may be more reserved about their requests and "internalize" their demand. Also, sons may be more likely to demand food, and girls may request resources other than food (e.g. clothing or beauty

products). When dealing with children's demands, parents may be more likely to give in when they are under economic stress.

One of the limitations is that I focus on families with sex-mixed children. It is also interesting to examine if father or mother would reduce more intakes in only child families. Given the presence of grandparents and their involvements in child care in China, the dietary intakes of grandparents could also be examined.

I only examine macronutrient intakes but not micronutrient intakes. Micronutrients, such as vitamins and minerals, play an important role in the healthy development of children. For future research, other dietary intakes could be examined when such data are available.

Another direction of future research is to include the price of food in the analysis. The CHNS provides detailed information on the price of rice, bread, meat, and oil in the local market. It would be interesting to examine if the negative income shock makes families opt out from expensive protein and opt in for cheap carbohydrate.

Apart from dietary intakes, it would be interesting to also examine time and consumption allocation within the household. For obesity research, for example, time spent in physical activity, TV and video games could be investigated and gender differences could be explored. The consumption patterns, such as pocket money (*Ling Hua Qian*) distribution and the frequency of western fast food restaurant visits, are also worthy of attention.

Table 4.1: Dietary Reference Intakes (DRIs): Recommended Dietary Allowances and Adequate Macronutrients Intakes

Group	Carbohydrate (g/d)	Fat (g/d)	Protein (g/d)	Energy calorie
Infants				
0 to 6 mo	60	31	9	555.4
6 to 12 mo	95	30	11	694
Children				0
1-3y	130	30	13	842
4-8y	130	30	19	866
Males		30		270
9-13y	130	30	34	926
14-18y	130	30	52	998
19-30y	130	30	56	1014
31-50y	130	30	56	1014
51-70y	130	30	56	1014
>70y	130	30	56	1014
Females		30		270
9-13y	130	30	34	926
14-18y	130	30	46	974
19-30y	130	30	46	974
31-50y	130	30	46	974
51-70y	130	30	46	974
>70y	130	30	46	974
Pregnancy		30		270
14-18y	175	30	71	1254
19-30y	175	30	71	1254
31-50y	175	30	71	1254
Lactation		30		270
14-18y	210	30	71	1394
19-30y	210	30	71	1394
31-50y	210	30	71	1394

Source: Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids (2002/2005) and Dietary Reference Intakes for Water, Potassium, Sodium, Chloride, and Sulfate (2005). The report may be accessed via www.nap.edu.

Fat intake of 1 to 70-year-old is from Dietary Reference Intakes (DRIs): Acceptable Macronutrient Distribution Ranges. The average of the range is used. Energy intake is calculated by the author using Energy(calorie)=9xFat(g)+4xCarb(g)+4xProtein(g). Energy from alcohol intake is ignored from the calculation because of lack of data. It is not likely to affect the estimation as the subject of the study is children of 2 to 17-year-old who are not likely to consume alcohol.

Table 4.2: Summary statistics of sibling sample of analysis

		Boy			Girl	
VARIABLES	N	Mean	SD	N	Mean	SD
Energy % dev	2,667	1.107	0.643	2,908	0.998	0.608
Carb % dev	2,667	1.529	0.919	2,908	1.387	0.848
Fat % dev	2,667	0.602	0.953	2,908	0.515	0.910
Protein % dev	2,667	0.703	0.725	2,908	0.597	0.655
Father Energy % deviation	2,488	1.693	0.726	2,699	1.696	0.736
Father Carb % deviation	2,488	2.466	1.120	2,699	2.466	1.136
Father Fat % deviation	2,488	1.088	1.162	2,699	1.102	1.197
Father Protein % deviation	2,488	0.405	0.435	2,699	0.411	0.438
Mother Energy % deviation	2,618	1.435	0.659	2,855	1.435	0.669
Mother Carb % deviation	2,618	2.070	0.988	2,855	2.063	0.996
Mother Fat % deviation	2,618	0.832	1.021	2,855	0.844	1.053
Mother Protein % deviation	2,618	0.482	0.464	2,855	0.490	0.469
%IncomeFall*Girl	2,362	0	0	2,563	0.124	0.240
%IncomeFall	2,362	0.122	0.238	2,563	0.124	0.240
NegativeShock*Girl	2,667	0	0	2,908	0.118	0.322
NegativeShock	2,667	0.114	0.318	2,908	0.118	0.322
Loss30	2,667	0.164	0.370	2,908	0.166	0.373
Loss20	2,667	0.190	0.393	2,908	0.192	0.394
Number of children	2,667	2.485	0.649	2,908	2.577	0.758
Number of extra hh members	2,667	2.453	0.813	2,908	2.461	0.846
Primary Schooling	2,667	0.313	0.464	2,908	0.338	0.473
Middle Schooling	2,667	0.175	0.380	2,908	0.220	0.414
Child at the age of puberty	2,667	0.522	0.500	2,908	0.346	0.476
Birth order	2,667	1.915	0.845	2,908	1.600	0.771
Equivalent Income	2,667	7,221	8,581	2,908	7,423	9,119
Rural residents	2,667	0.814	0.389	2,908	0.813	0.390
Number of families	1,312	1,312	1,312	1,312	1,312	1,312

Source: CHNS 1991 to 2011. Children 2 to 17 year old. Sample of children with siblings of opposite sex. At least two children in one family are surveyed in one cycle.

Note: % dev of energy, carb, fat and protein is the percentage deviation of macronutrient intake from the age- and gender-specific DRIs standards. Equivalent income is defined as household income after tax and transfer divided by square root of household size. NegShock is defined as 1 if the equivalent income falls more than 25% from the average of previous 3 cycles, 0 otherwise. Loss30, Loss25, Loss20 are defined as the income loss of 30, 25 and 20 percent from the previous cycle

Table 4.3: Reasons for negative income shock

	No negshock					With neg shock				
VARIABLES	N	Mean	Sd	Max	Min	N	Mean	Sd	Max	Min
Reasons for negative income shock										
Illness	2,323	0.313	0.464	1	0	272	0.346	0.476	1	0
Unemployment	5,956	0.153	0.360	1	0	688	0.173	0.378	1	0
Family dissolution	5,935	0.0136	0.116	1	0	682	0.0323	0.177	1	0
Old age	6,014	0.00449	0.0669	1	0	695	0.00288	0.0536	1	0
Channels: dietary attitu de										
Diet knowledge: lot of sugar is good (1-5)	374	2.214	0.673	5	1	40	2.625	0.952	5	2
Diet knowledge: diet high in fat (1-5)	359	2.228	0.768	5	1	40	2.325	0.829	5	1
Diet knowledge: lot of staple food (1-5)	352	2.861	0.958	5	1	41	3.195	0.901	4	2
Diet knowledge: lot of animal products (1-5)	379	2.879	1.032	5	1	41	3.073	1.058	5	1
Diet knowledge: heavier body (1-5)	380	1.939	0.661	5	1	40	2.100	0.871	5	1
Number of families	1,358	1,358	1,358	1,358	1,358	1,358	1,358	1,358	1,358	1,358

Note: CHNS 1991 to 2011.
Unemployment=1 if either parent changed or lost jobs since the last survey. Illness=1 if either parent has self-reported health of 1 or 2 on a 4-point scale, or self-reported hypertension, diabetes, myocardial diseases, stroke or cancer. Family dissolution=1 if either parent reports single, divorced, widowed or separated. Old age=1 if father is older than 60 or mother is older than 55.

Diet knowledge is asked for children 12 and older in cycles 2004 to 2011. 5 represents strongly agree and 1 is strongly disagree.

Table 4.4: Estimates of child intake with sibling fixed effects, children with siblings of opposite sex.

VARIABLES	(1) Energy % dev	(2) Energy % dev	(3) Energy % dev	(4) Carb % dev	(5) Carb % dev	(6) Carb % dev	(7) Fat % dev	(8) Fat % dev	(9) Fat % dev	(10) Protein % dev	(11) Protein % dev	(12) Protein % dev
NegativeShock*Girl	-0.0468	-0.0814**	-0.0754**	-0.0742*	-0.148***	-0.145***	-0.0165	-0.0108	-0.0113	-0.0967**	-0.0592	-0.0400
	(0.0319)	(0.0320)	(0.0315)	(0.0448)	(0.0411)	(0.0413)	(0.0344)	(0.0390)	(0.0393)	(0.0382)	(0.0384)	(0.0382)
NegativeShock	0.0992***	0.0335	0.0537	0.213***	0.124***	0.140***	0.0268	-0.0663	0.0304	-0.152***	-0.0608	-0.160***
	(0.0370)	(0.0383)	(0.0411)	(0.0456)	(0.0460)	(0.0503)	(0.0554)	(0.0596)	(0.0667)	(0.0432)	(0.0439)	(0.0507)
Log eq income			0.0264			0.0269			0.0864***			-0.0827***
			(0.0193)			(0.0230)			(0.0314)			(0.0229)
Observations	6,930	5,645	5,575	6,930	5,645	5,575	6,930	5,645	5,575	6,930	5,645	5,575
R-squared	0.008	0.072	0.074	0.013	0.134	0.136	0.009	0.052	0.057	0.014	0.136	0.141
Number of fixedm	1,380	1,320	1,312	1,380	1,320	1,312	1,380	1,320	1,312	1,380	1,320	1,312
HH characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Child Characteristics	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Sibling fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: CHNS 1991 to 2011. Children 2 to 17 year old. Sample of children with siblings of opposite sex. At least two children in one family are surveyed in one cycle.
Note: Standard errors clustered by families in parentheses. *p<.1; **p<.05; ***p<.01.

The dependent variable is the percentage deviation of macronutrient intake from the age- and gender-specific DRIs standards. HH characteristics include number of children in the household and number of other relative and non-relatives in the household. Child characteristics include if the child has graduated from primary school or middle school, puberty onset and birth order. Log equivalent income is defined as household income after tax and transfer divided by square root of household size. Constant is included in the estimation. NegShock is defined as 1 if the equivalent income falls more than 25% from the average of previous 3 cycles, 0 otherwise.

Table 4.5: Estimates of child intake with sibling fixed effects, children of sex mix adolescent sample.

VARIABLES	(1) Energy % dev	(2) Energy % dev	(3) Energy % dev	(4) Carb % dev	(5) Carb % dev	(6) Carb % dev	(7) Fat % dev	(8) Fat % dev	(9) Fat % dev	(10) Protein % dev	(11) Protein % dev	(12) Protein % dev
NegativeShock*Girl	-0.182***	-0.211***	-0.193***	-0.239***	-0.312***	-0.294***	-0.182**	-0.201***	-0.196**	-0.0849*	-0.0188	0.000327
	(0.0601)	(0.0624)	(0.0604)	(0.0833)	(0.0839)	(0.0846)	(0.0717)	(0.0772)	(0.0774)	(0.0504)	(0.0525)	(0.0516)
NegativeShock	0.0111	0.0344	0.0924	0.135	0.160*	0.244**	-0.0835	-0.0658	0.0198	-0.110**	-0.0897*	-0.0982
	(0.0664)	(0.0661)	(0.0742)	(0.0859)	(0.0862)	(0.0963)	(0.0980)	(0.0970)	(0.114)	(0.0554)	(0.0543)	(0.0616)
Log eq income			0.0506			0.0785*			0.0555			-0.00129
			(0.0343)			(0.0447)			(0.0495)			(0.0300)
Observations	2,468	2,421	2,396	2,468	2,421	2,396	2,468	2,421	2,396	2,468	2,421	2,396
R-squared	0.021	0.029	0.030	0.026	0.049	0.051	0.018	0.023	0.024	0.025	0.101	0.098
Number of fixedm	1,076	1,060	1,052	1,076	1,060	1,052	1,076	1,060	1,052	1,076	1,060	1,052
HH characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Child Characteristics	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Sibling fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: CHNS 1991 to 2011. Children 2 to 17 year old. Sample of children with siblings of opposite sex. At least two children in one family are surveyed in one cycle.
Note: Standard errors clustered by families in parentheses. *p<.1; **p<.05; ***p<.01.

The dependent variable is the percentage deviation of macronutrient intake from the age- and gender-specific DRIs standards. HH characteristics include number of children in the household and number of other relative and non-relatives in the household. Child characteristics include if the child has graduated from primary school or middle school, puberty onset and birth order. Log equivalent income is defined as household income after tax and transfer divided by square root of household size. Constant is included in the estimation. NegShock is defined as 1 if the equivalent income falls more than 25% from the average of previous 3 cycles, 0 otherwise.

Table 4.6: Estimates of parents' intakes with family fixed effects, parents with children of sex mix sample.

VARIABLES	(1) Energy % dev	(2) Energy % dev	(3) Energy % dev	(4) Carb % dev	(5) Carb % dev	(6) Carb % dev	(7) Fat % dev	(8) Fat % dev	(9) Fat % dev	(10) Protein % dev	(11) Protein % dev	(12) Protein % dev
NegativeShock*Mother	-0.289***	-0.305***	-0.285***	-0.471***	-0.498***	-0.463***	-0.270***	-0.246***	-0.246***	0.0593***	0.0332*	0.0427***
	(0.0275)	(0.0280)	(0.0272)	(0.0403)	(0.0405)	(0.0395)	(0.0307)	(0.0318)	(0.0327)	(0.0163)	(0.0170)	(0.0164)
NegativeShock	0.0402	0.0756*	0.00915	0.126**	0.191***	0.0478	0.0427	0.00945	0.0367	-0.0921***	-0.0562**	-0.0602**
	(0.0436)	(0.0425)	(0.0484)	(0.0598)	(0.0566)	(0.0648)	(0.0674)	(0.0686)	(0.0787)	(0.0262)	(0.0259)	(0.0295)
Log eq income			-0.0447**			-0.102***			0.0230			0.00253
			(0.0204)			(0.0272)			(0.0343)			(0.0134)
Constant	1.318***	2.207***	2.527***	1.830***	3.418***	4.131***	1.164***	0.614*	0.488	0.238**	0.960***	0.948***
	(0.199)	(0.232)	(0.269)	(0.271)	(0.318)	(0.368)	(0.347)	(0.353)	(0.442)	(0.115)	(0.140)	(0.166)
Observations	13,235	13,141	12,961	13,235	13,141	12,961	13,235	13,141	12,961	13,235	13,141	12,961
R-squared	0.025	0.047	0.047	0.029	0.064	0.067	0.005	0.008	0.008	0.010	0.036	0.036
Number of fixedm	1,373	1,368	1,360	1,373	1,368	1,360	1,373	1,368	1,360	1,373	1,368	1,360
HH characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual characteristics	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Family fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: CHNS 1991 to 2011. Children 2 to 17 year old. Sample of children with siblings of opposite sex. At least two children in one family are surveyed in one cycle.
Note: Standard errors clustered by families in parentheses. *p<.1; **p<.05; ***p<.01.

The dependent variable is the percentage deviation of macronutrient intake from the age- and gender-specific DRIs standards. HH characteristics include number of children in the household and number of other relative and non-relatives in the household. Individual characteristics include levels of education. Log equivalent income is defined as household income after tax and transfer divided by square root of household size. Constant is included in the estimation. NegShock is defined as 1 if the equivalent income falls more than 25% from the average of previous 3 cycles, 0 otherwise.

Table 4.7: Estimates of parents' and children's intakes with family fixed effects, families with children of sex mix sample.

VARIABLES	(1) Energy % dev	(2) Energy % dev	(3) Energy % dev	(4) Carb % dev	(5) Carb % dev	(6) Carb % dev	(7) Fat % dev	(8) Fat % dev	(9) Fat % dev	(10) Protein % dev	(11) Protein % dev	(12) Protein % dev
NegativeShock*Girl	-0.0814**	-0.113***	-0.0963***	-0.123***	-0.175***	-0.155***	-0.0395	-0.0763**	-0.0684*	-0.103***	-0.0601*	-0.0448
	(0.0326)	(0.0320)	(0.0317)	(0.0471)	(0.0449)	(0.0456)	(0.0366)	(0.0381)	(0.0388)	(0.0373)	(0.0361)	(0.0354)
NegativeShock*Mother	0.341***	-0.140***	-0.134***	0.568***	-0.186***	-0.184***	0.242***	-0.184***	-0.173***	-0.224***	0.0441	0.0544
	(0.0355)	(0.0368)	(0.0371)	(0.0524)	(0.0537)	(0.0549)	(0.0355)	(0.0402)	(0.0411)	(0.0334)	(0.0342)	(0.0338)
NegativeShock*Father	0.633***	0.107***	0.0976**	1.043***	0.213***	0.188***	0.514***	0.0455	0.0550	-0.282***	0.0306	0.0307
	(0.0401)	(0.0404)	(0.0418)	(0.0619)	(0.0607)	(0.0629)	(0.0433)	(0.0466)	(0.0485)	(0.0346)	(0.0351)	(0.0352)
NegativeShock	-0.349***	-0.0765**	-0.175***	-0.519***	-0.0912*	-0.273***	-0.296***	-0.0420	-0.0116	0.0737*	-0.0893**	-0.137***
	(0.0374)	(0.0388)	(0.0425)	(0.0491)	(0.0510)	(0.0565)	(0.0569)	(0.0587)	(0.0664)	(0.0408)	(0.0407)	(0.0425)
Log eq income			-0.0928***			-0.179***			0.0362			-0.0420***
			(0.0185)			(0.0243)			(0.0308)			(0.0138)
Constant	1.312***	0.590***	1.484***	1.754***	0.603**	2.311***	1.230***	0.654**	0.330	0.279**	0.648***	1.052***
	(0.166)	(0.193)	(0.261)	(0.214)	(0.267)	(0.357)	(0.306)	(0.318)	(0.408)	(0.128)	(0.120)	(0.176)
Observations	20,165	18,786	18,536	20,165	18,786	18,536	20,165	18,786	18,536	20,165	18,786	18,536
R-squared	0.030	0.186	0.193	0.038	0.228	0.242	0.010	0.071	0.071	0.013	0.097	0.100
Number of fixedm	1,380	1,372	1,364	1,380	1,372	1,364	1,380	1,372	1,364	1,380	1,372	1,364
HH characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual characteristics	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Family fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: CHNS 1991 to 2011. Children 2 to 17 year old. Sample of children with siblings of opposite sex. At least two children in one family are surveyed in one cycle.
Note: Standard errors clustered by families in parentheses. *p<.1; **p<.05; ***p<.01.

The dependent variable is the percentage deviation of macronutrient intake from the age- and gender-specific DRIs standards. HH characteristics include number of children in the household and number of other relative and non-relatives in the household. Individual characteristics include levels of education. Log equivalent income is defined as household income after tax and transfer divided by square root of household size. Constant is included in the estimation. NegShock is defined as 1 if the equivalent income falls more than 25% from the average of previous 3 cycles, 0 otherwise.

Table 4.8: Sibling fixed effects estimates of dietary intake on percentage income fall (continuous measure). Child with the opposite sex sibling sample

VARIABLES	(1) Energy % dev	(2) Energy % dev	(3) Energy % dev	(4) Carb % dev	(5) Carb % dev	(6) Carb % dev	(7) Fat % dev	(8) Fat % dev	(9) Fat % dev	(10) Protein % dev	(11) Protein % dev	(12) Protein % dev
%IncomeFall*Girl	-0.0797**	-0.136***	-0.159***	-0.0937*	-0.227***	-0.261***	-0.0436	-0.0294	-0.0527	-0.232***	-0.136**	-0.122**
	(0.0396)	(0.0387)	(0.0399)	(0.0564)	(0.0514)	(0.0533)	(0.0422)	(0.0489)	(0.0510)	(0.0543)	(0.0532)	(0.0540)
%IncomeFall	0.120**	0.0847	0.233***	0.256***	0.225***	0.413***	0.0100	-0.0871	0.181	-0.124*	-0.0412	-0.258***
	(0.0561)	(0.0584)	(0.0774)	(0.0708)	(0.0716)	(0.0971)	(0.0789)	(0.0856)	(0.117)	(0.0665)	(0.0662)	(0.0936)
Log eq income			0.0752***			0.0963***			0.132***			-0.101***
			(0.0252)			(0.0307)			(0.0416)			(0.0313)
Observations	5,705	4,982	4,925	5,705	4,982	4,925	5,705	4,982	4,925	5,705	4,982	4,925
R-squared	0.008	0.074	0.079	0.011	0.135	0.141	0.008	0.052	0.059	0.017	0.140	0.146
Number of fixedm	1,207	1,172	1,166	1,207	1,172	1,166	1,207	1,172	1,166	1,207	1,172	1,166
HH characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Child Characteristics	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Sibling fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: CHNS 1991 to 2011. Children 2 to 17 year old. Sample of children with siblings of opposite sex. At least two children in one family are surveyed in one cycle.
Note: Standard errors clustered by families in parentheses. *p<.1; **p<.05; ***p<.01.

The dependent variable is the percentage deviation of macronutrient intake from the age- and gender-specific DRIs standards. HH characteristics include number of children in the household and number of other relative and non-relatives in the household. Child characteristics include if the child has graduated from primary school or middle school, puberty onset and birth order. Log equivalent income is defined as household income after tax and transfer divided by square root of household size. Constant is included in the estimation. The %IncomeFall is defined as the percentage income fall from previous cycle using CPI adjusted household equivalent disposable income.

Table 4.9: Sibling fixed effects estimates of dietary intake on percentage income fall (continuous measure). Adolescents with the opposite sex sibling sample

VARIABLES	(1) Energy % dev	(2) Energy % dev	(3) Energy % dev	(4) Carb % dev	(5) Carb % dev	(6) Carb % dev	(7) Fat % dev	(8) Fat % dev	(9) Fat % dev	(10) Protein % dev	(11) Protein % dev	(12) Protein % dev
%IncomeFall*Girl	-0.279***	-0.321***	-0.330***	-0.384***	-0.507***	-0.527***	-0.193**	-0.219**	-0.239**	-0.208***	-0.0690	-0.0495
	(0.0710)	(0.0756)	(0.0791)	(0.101)	(0.105)	(0.110)	(0.0859)	(0.0932)	(0.0979)	(0.0738)	(0.0758)	(0.0775)
%IncomeFall	0.0769	0.0954	0.382***	0.263**	0.288**	0.720***	-0.118	-0.110	0.130	-0.0736	-0.0674	-0.0493
	(0.0934)	(0.0937)	(0.134)	(0.124)	(0.125)	(0.169)	(0.136)	(0.137)	(0.206)	(0.0811)	(0.0772)	(0.108)
Log eq income			0.132***			0.199***			0.109			0.0122
			(0.0463)			(0.0582)			(0.0720)			(0.0399)
Observations	2,223	2,188	2,170	2,223	2,188	2,170	2,223	2,188	2,170	2,223	2,188	2,170
R-squared	0.020	0.030	0.040	0.028	0.055	0.068	0.017	0.022	0.026	0.026	0.106	0.103
Number of fixedm	962	951	946	962	951	946	962	951	946	962	951	946
HH characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Child Characteristics	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Sibling fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

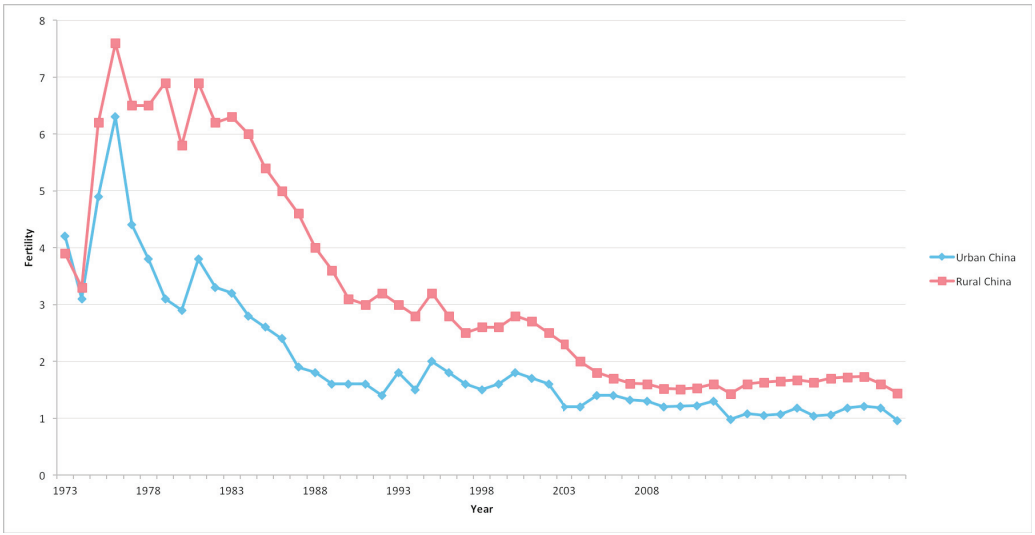
Source: CHNS 1991 to 2011. Children 2 to 17 year old. Sample of children with siblings of opposite sex. At least two children in one family are surveyed in one cycle.
Note: Standard errors clustered by families in parentheses. *p<.1; **p<.05; ***p<.01.

The dependent variable is the percentage deviation of macronutrient intake from the age- and gender-specific DRIs standards. HH characteristics include number of children in the household and number of other relative and non-relatives in the household. Child characteristics include if the child has graduated from primary school or middle school, puberty onset and birth order. Log equivalent income is defined as household income after tax and transfer divided by square root of household size. Constant is included in the estimation. The %IncomeFall is defined as the percentage income fall from previous cycle using CPI adjusted household equivalent disposable income.

Figure 4.1: Map of China with CHNS provinces

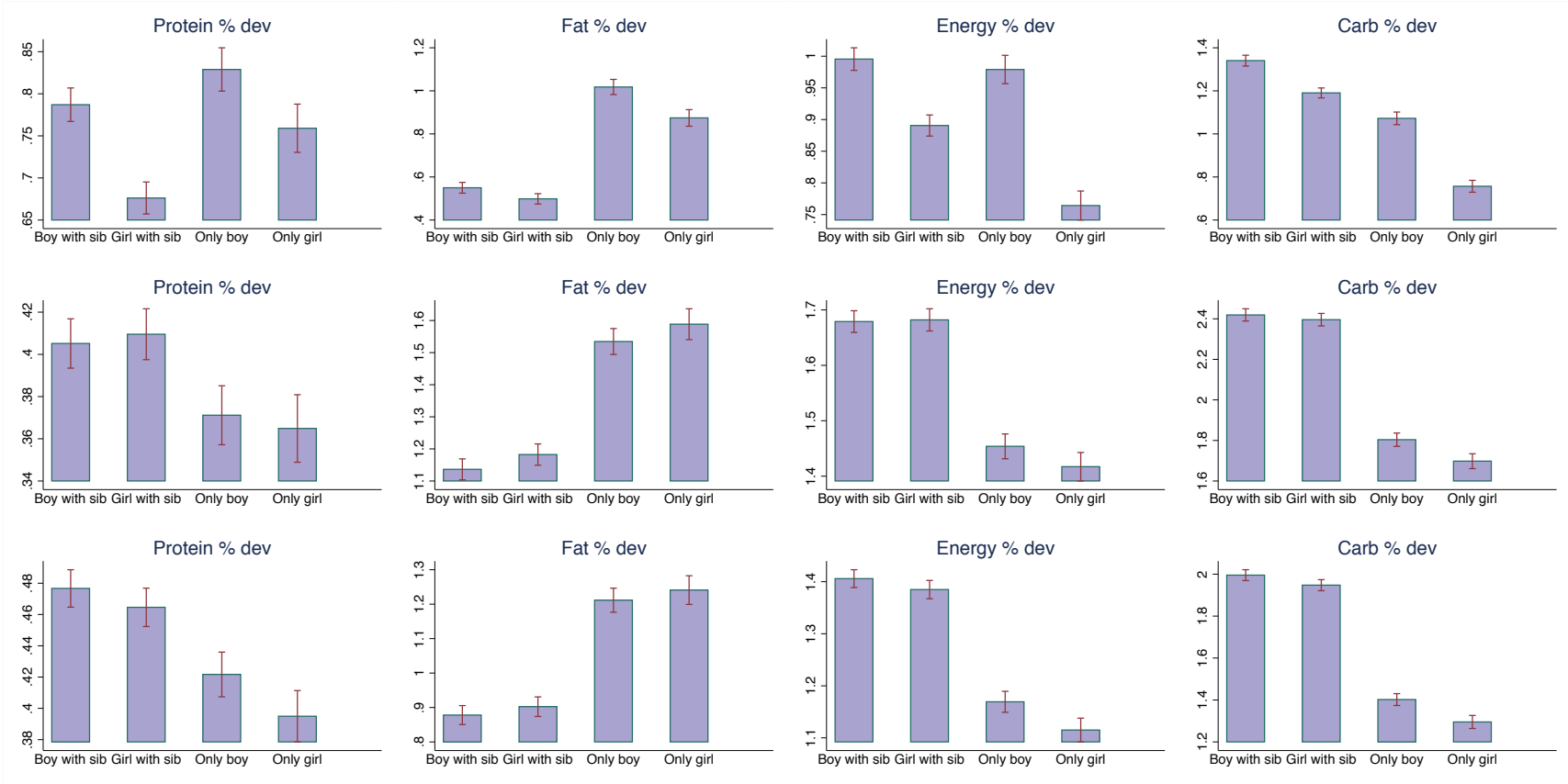
Source: China Health and Nutrition Survey website:
www.cpc.unc.edu/projects/china

Figure 4.2: Fertility Rate for Rural and Urban China (1973-2010)



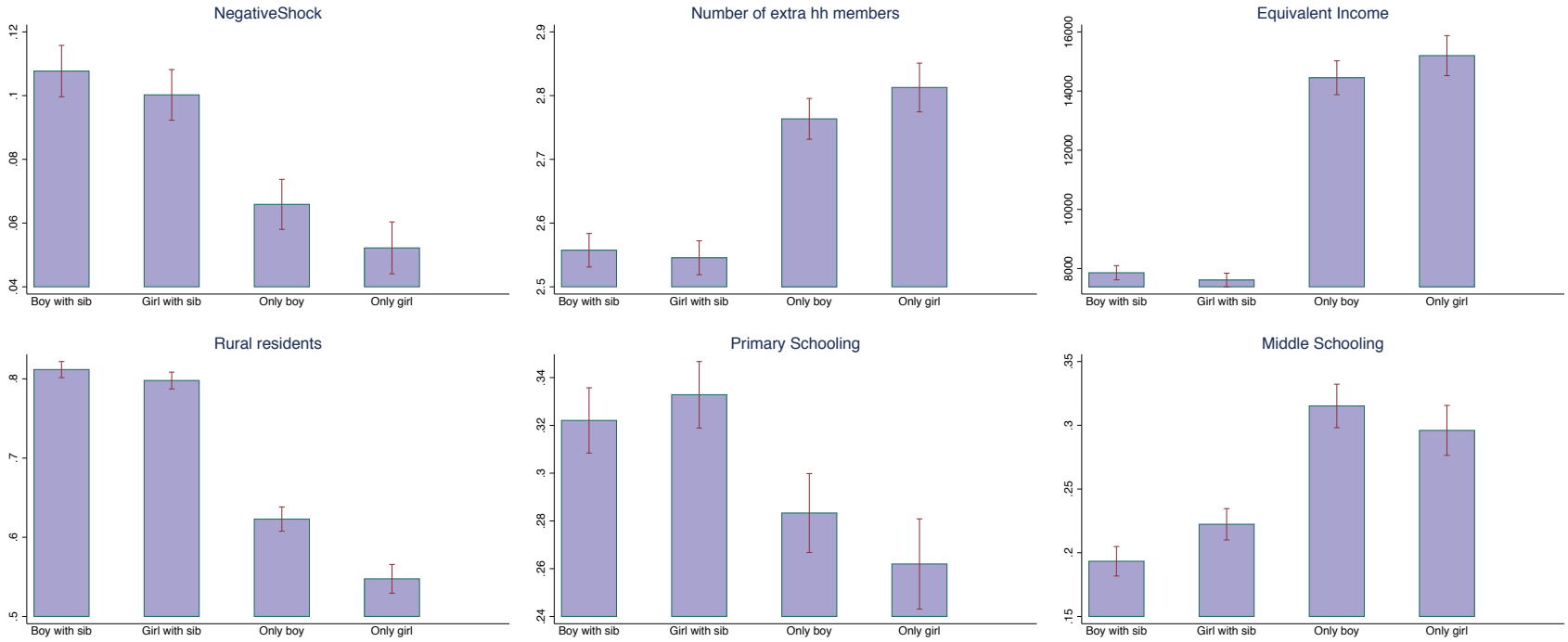
Source: The figure is reproduced based on data from Zhang (2017). It is originally compiled from Peng and Guo (2017) for 1973-1992 data; the 2001 National Fertility and Reproductive Health Survey for 1993-1999; Juan and Qiu (2011) for 2001-2009 data; and the national population censuses for 2000 and 2010 data.

Figure 4.3: Outcome variables by gender and single child status



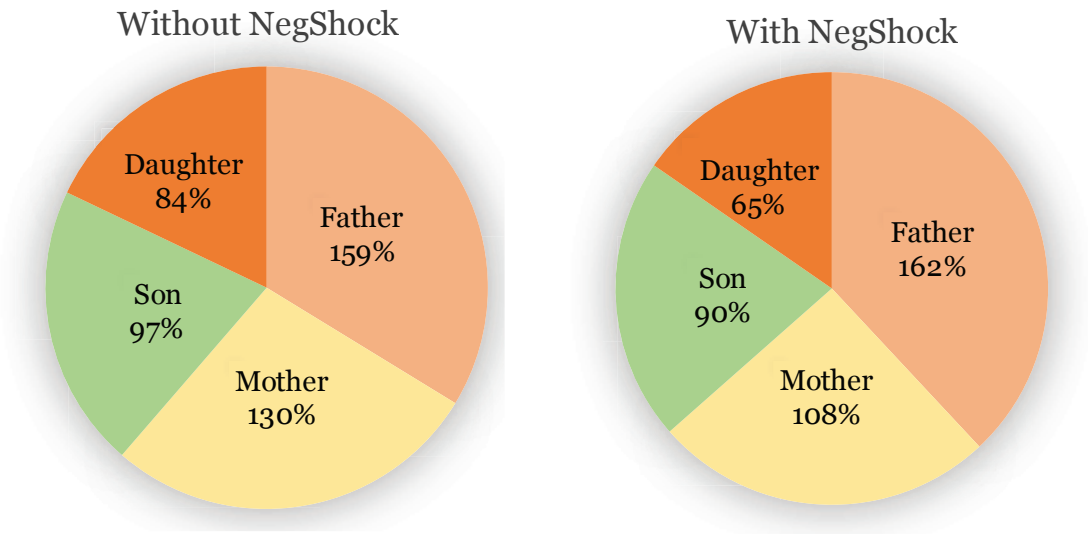
Note: CHNS 1991 to 2011. Children 2 to 17 year old. Sibling sample and single child sample. $\%Dev$ is defined as the percentage deviation of macronutrient intakes from the age- and gender-specific DRIs standards.

Figure 4.4: Independent variables by gender and single child status



Note: CHNS 1991 to 2011. Children 2 to 17 year old. Sibling sample and single child sample. *NegShock* is defined as 1 if the equivalent income falls more than 25% from the average of previous 3 cycles, 0 otherwise. *Number of extra hh members* is defined as household size minus two parents minus number of children (e.g. number of grandparents, relatives, and non-relatives). *Equivalent income* is defined as household income after tax and transfer divided by square root of household size.

Figure 4.5: Energy distribution with and without negative income shock



Source: Author's calculation. Note: The without income shock is used from the mean energy intakes of the sample. The with income shock is calculated using the estimates from Table 4.7 Specification 2. The percentage deviation of energy intake from DRIs standard is labelled.

Chapter 5

Conclusion

In this dissertation, I examine the links between parental economic insecurity and child development. Economic insecurity does not have a unified measure (Osberg, 2015a). Therefore, I examine three different measures of economic insecurity in my three essays. First, I use subjective measure, where parents are directly asked if they worry about having enough money to support their families. The second essay uses objective measures of layoff rates and financial loss in the event of layoffs at the provincial and year level. In the third essay, a 25% income loss from previous years is used. Economic insecurity examined in this dissertation combines subjective and objective measures at the individual, household, and provincial level. By engaging different measures, I provide a multidimensional overview of the prevalence and the severity of economic insecurity.
To draw causal conclusions, I use two methods in the three essays. The second essay uses continuous difference-in-difference methodology. The third essay adopts sibling fixed effects to control for unobserved heterogeneity in the family. By employing the three econometric techniques, I hope to provide strong evidence to infer the causal relationship of parental economic insecurity and the adversity of child outcomes.

In the dissertation, I investigate the parental economic insecurity and child development in both China and Canada. The two countries vary in economic development, welfare state, constitutions, cultures, population size, and political attitudes. I adopt the concept and methodology of economic insecurity and bring them to Chinese studies. China's pension, social assistance programs, and employment insurances are severely underdeveloped, which contributes to a high level of economic insecurity. However, economic insecurity is highly understudied in China. I adapt my focus of the study to the country-specific environment. I provide evidence to China-specific issues (e.g. layoffs and son-favoritism). By doing so, I hope

to bridge the studies of two cultures and draw attention to the insecurity in both countries.

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Appendix

Children's well-being outcomes The three indices for children's well-being outcomes are derived from multiple questions answered by PMKs. The questions and answers follow the same format: "Using the answers never or not true, sometimes or somewhat true, or often or very true, how often would you say that this child. . . " For all of the questions, never or not true is assigned 0, sometimes or somewhat true is 1, and often or very true is 2. Then the score from each question is combined under the same index. Here is the list of questions asked for hyperactivity/inattention score, emotional disorder/anxiety score and conduct disorder/physical aggression score:
Hyperactivity - Inattention score (12-point scale) is derived from the following six questions:

1. . . . can't sit still or is restless?
2. . . . is easily distracted, has trouble sticking to any activity?
3. . . . can't concentrate, can't pay attention for long?
4. . . . cannot settle on anything for more than a few moments?
5. . . . has difficulty waiting for his turn in games or groups?
6. . . . is inattentive?

Emotional Disorder-Anxiety Score (12-point scale) is derived from the following six questions:

1. . . . seems to be unhappy or sad?
2. . . . is not as happy as other children?
3. . . . is too fearful or nervous?
4. . . . is worried?
5. . . . is nervous, high strung or tense?
6. . . . has trouble enjoying him/herself?

Parenting style

Consistent parenting style score (20-point scale) is derived from the questions below. The answers to these questions ranging from 0 (never) to 4 (all the time). The values of last three questions are reversed for the calculation.

1. When you give this child a command or order to do something, what proportion of the time do you make sure that he does it?
2. If you tell this child he will get punished if he doesn't stop doing something, and he keeps doing it, how often will you punish him?
3. How often does this child get away with things for which you feel he should have been punished?
4. How often is this child able to get out of a punishment when he really sets his mind to it?
5. How often when you discipline this child, does he ignore the punishment?

Positive interaction score (20-point scale) are derived from the questions below. These questions take the value 0 if never, 1 if about once a week or less, 2 if a few times a week, 3 one or two times a day, and 4 many times each day.

1. 1. How often do you praise this child, by saying something like 'Good for you!' or 'What a nice thing you did!' or 'That's good going!'?
2. How often do you and this child talk or play with each other, focusing attention on each other for five minutes or more, just for fun?
3. How often do you and this child laugh together?
4. How often do you do something special with this child that he enjoys?
5. How often do you play sports, hobbies or games with this child?

Ineffective parenting style score ranges from 0 to 28. It is derived from the following seven questions with the same calculation as above.

1. How often do you get annoyed with this child for saying or doing something he is not supposed to?

2. Of all the times that you talk to this child about his behaviour, what proportion is praise? (reversed)
3. Of all the times that you talk to this child about his behaviour, what proportion is disapproval?
4. How often do you get angry when you punish this child?
5. How often do you think that the kind of punishment you give this child depends on your mood?
6. How often do you feel you are having problems managing this child in general?
7. How often do you have to discipline this child repeatedly for the same thing?

Irrational parenting style score is on 16-point scale. Parents are asked to answer the questions from 0 "Never" to 4 "Always". The four questions are asked as following: "Please tell me how often you, as his parent, do each of the following when this child breaks the rules or does things that he is not supposed to:"

1. ...raise your voice, scold or yell at him?
2. ...calmly discuss the problem? (reversed)
3. ...use physical punishment?
4. ...describe alternative ways of behaving that are acceptable? (reversed)

State-owned units: various enterprises, institutions, and government administrative organizations at various levels, social organizations, etc., with state ownership of production means.

Urban collective owned units: various enterprises and institutions with collective ownership of production means, including various rural economic organizations engaging in agriculture, forestry, animal husbandry and fishery, enterprises, and institutions run by townships and villages. Or run by cities, countries, towns, and neighbourhood committees.

Other Ownership Units:: jointly owned units, share-holding units, foreign-funded units, overseas Chinese from Hong Kong, Macao, and Taiwan-funded units, etc.

Laid-off workers: due to the production or operational difficulties of the state-sector enterprises, employees leave the job involuntarily, and do not work for other jobs in the same enterprise. They still remain the labour relation with the original enterprises (National Bureau of Labour & National Bureau of Statistics of China, 1997)