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Abstract of the Dissertation

Three Essays on Applied Microeconomics

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Professor Kathleen McGarry, Chair

In these essays, I examine two broad topics in applied microeconomics using Chinese datasets: (i) intergenerational relationship between elderly parents and adult children (ii) the effect of a tax reform on labor sector choices in rural China. The first chapter develops a theoretical framework for studying the residential choice of adult children in an intergenerational context. Parents value time spent with child regardless of whether the child provides any assistance and distance is a key determinant for the cost of this time transfer. Hence parents and parents-in-law have incentives to bid strategically for the proximity of married couple. The full characterization of the model leads to an equilibrium location pattern with single children locating significantly closer to their parents than married children. The model also predicts that there is no gender difference in residential choices among single children. However, on average married females will locate further away from parents than married males. Then I empirically analyze the location pattern using Taiwan Panel data and find that results are consistent with theoretical predictions. The second chapter examines reporting discrepancies over intergenerational exchange and support among 2,479 parent-child dyads drawn from Surveys of Health and Living Status of the Elderly in Taiwan. In line with previous literature, I find high degree of agreement between how adult children and elderly parents perceive their relationship. However, children consistently report greater level of exchange of assistance both from parents and to parents. I argue that this phenomenon is mainly due to the inconsistency of question wordings in the parents' and children's surveys. I then analyze whether the empirical results identify different effects of observable characteristics on transfer decisions, if reports from distinctive generations are used. I find that the conclusions remain largely

unchanged under those different reports. The third chapter examines the labor supply response under an exogenous tax reform in rural China that changes the household level lump sum tax. Contrary to the standard economic theory, for households with increasing total tax payment I find a shift away from pure farm production to a combination of agricultural and nonagricultural sector employment. I hypothesize that this is because the reform increases the marginal risk premium in agricultural sector due to the uncertainty in farm production, imperfection of risk insurance market and decreasing absolute risk aversion. I then test this hypothesis by examining the heterogeneous treatment effects along several dimensions. First, I observe a shift from (nonagricultural) self-employment to wage earning sectors. Then, I find treatment effect is larger for households facing greater risk in agricultural production. Finally, households' precautionary savings seem to increase in the treated group after the reform. All those observations are consistent with the theory predictions.

The dissertation of Ziyan Huang is approved.

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2013

To my parents

Table of Contents

1 The Residential Choice of Adult Children: Competition between Parents and Parent-in-Law . . . 1

1.1 Introduction . . . 1

1.2 Theoretical Framework . . . 5

1.2.1 Single Child . . . 8

1.2.2 Married Couple . . . 9

1.2.3 Discussion . . . 16

1.3 Empirical Analysis . . . 19

1.3.1 Baseline Results . . . 22

1.3.2 Matched Couples . . . 25

1.3.3 Siblings Composition . . . 28

1.3.4 Downward Transfers . . . 30

1.3.5 Robustness Check . . . 32

1.4 Potential Complications . . . 33

1.5 Policy Implications and Conclusion . . . 34

1.6 Appendix . . . 36

1.6.1 PROOF OF LEMMA 1 . . . 36

1.6.2 PROOF OF LEMMA 2 . . . 37

1.6.3 PROOF OF PROPERTY 1 . . . 39

1.6.4 PROOF OF PROPOSITION 1 . . . 40

References . . . 44

2 Elderly Parents' and Children's Reports on Intergenerational Transfers: Do They Agree with Each Other? . . . 58

2.1 Introduction . . . 58

2.2 Literature Review 60
2.3 Empirical Analysis 62
2.3.1 Summary Statistics 64
2.3.2 Potential Explanations for Discrepancy 66
2.3.3 Observable Characteristics and Transfer Behavior 68
2.4 Data Collection for Intergenerational Studies 73
2.4.1 Sampling and Coverage 73
2.4.2 Interview Format 75
2.4.3 Content 76
2.5 Conclusion and Discussion 79
2.6 Appendix 81

References **86**

3 Lump Sum Tax and Sector Choices: Evidence from a Tax Reform in Rural China **99**

3.1 Introduction 99
3.2 Institutional Background and Data 102
3.2.1 Rural Taxation in China 102
3.2.2 Tax Reform 103
3.2.3 Data 109
3.3 Estimation of Basic Treatment Effects 109
3.3.1 Treatment Group and Control Group 109
3.3.2 Change in Total Tax Payment 110
3.3.3 Treatment Effects on Labor Supply Outcomes 113
3.4 Theoretical Framework 115
3.5 Heterogeneous Treatment Effects 118
3.5.1 Self-Employment versus Wage Earning Employment 119

3.5.2 Risk in Agricultural Production 120
3.5.3 Savings 124
3.6 Robustness Check 125
3.6.1 Household Size and Land Area 125
3.6.2 Compulsory Labor Requirement 126
3.6.3 Labor Demand and Other Possible Confounding Projects 127
3.7 Discussion 129
3.8 Conclusion 130
3.9 Appendix 131
3.9.1 PROOF OF RESULT1 131
3.9.2 PROOF OF RESULT2 131
3.9.3 PROOF OF RESULT3 132

References **134**

List of Figures

1.1 Characterization of Subgame-Perfect Equilibrium Location with $\lceil (A + K_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil < K_2$ 47

1.2 Characterization of Subgame-Perfect Equilibrium Location with $\lfloor (A + K_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rfloor > K_2$ 47

3.1 Provincial Fiscal Revenue from Agricultural Taxation 1998-2001 137

3.2 Provincial Extra-Budgetary Revenues 1998-2001 137

3.3 Geographic Locations of Treatment and Control Provinces 138

3.4 Percentage of Individuals Whose Prime Job is in Agricultural Sector . . . 138

3.5 Number of All State-Owned and Non-State-Owned above Designated Size Industrial Enterprises 139

3.6 Gross Output Values of All State-Owned and Non-State-Owned above Designated Size Industrial Enterprises (1990 Yuan) 139

3.7 Number of Employed persons in TVEs (Township and village Enterprises) in Rural Area 140

3.8 Number of State-Owned and State-Holding Enterprises 140

3.9 Gross Output Values of State-Owned and State-Holding Enterprises . . . 141

3.10 Number of Collective-Owned Enterprises 141

3.11 Gross Output Value of Collective-Owned Enterprises 142

3.12 Number of Sharing-Holding Corporation Ltd. 142

3.13 Gross Output Value of Sharing-Holding Corporation Ltd. 143

List of Tables

1.1 Summary Statistics by Child Type 48

1.2 Distance between Parents and Children by Child Type 49

1.3 Ordinal Logistic Regression of Distance Choices (Whole Sample) 50

1.4 Ordinal Logistic Regression of Distance Choices by Child Type 51

1.5 Summary Statistics for Matched Couples 52

1.6 Ordinal Logistic Regression of Distance Choice for Matched Couples . . . 53

1.7 Ordinal Logistic Regression of Distance Choice for Sibling Composition . 54

1.8 Logistic Regression of Downward Transfers 55

1.9 Ordinal Logistic Regression of Distance Choice by Age of Oldest Parent . 56

1.10 Ordinal Logistic Regression of Distance Choice by Movers 57

2.1 Summary Statistics by Sample Selection - Elderly Respondents 90

2.2 Summary Statistics - Adult Children 91

2.3 Parents' and Children's Report on Intergenerational Transfers 92

2.4 Correspondence in Parents' and Children's Report on Financial Transfers 93

2.5 Correspondence in Parents' and Children's Report on Time Transfers . . 94

2.6 Logit Regression on Financial Transfers from Parents to Children 95

2.7 Logit Regression on Financial Transfers from Children to Parents 96

2.8 Logit Regression on Time Transfers from Parents to Children 97

2.9 Logit Regression on Time Transfers from Children to Parents 98

3.1 Summary Statistics of Treatment and Control Groups 144

3.2 Exogeneity of Reform 145

3.3 Change of Tax Payment (Household Level) 146

3.4 Treatment Effects on Household Sector-Specific Participation Rate 147

3.5 Treatment Effects on Household Sector-Specific Conditional Working Days 148

3.6 Self-Employment and Wage Earning Activities 149
3.7 Heterogeneous Treatment Effects according to Risk in Agricultural Production I 150
3.8 Heterogeneous Treatment Effects according to Risk in Agricultural Production II 151
3.9 Treatment Effects on Savings 152
3.10 Change of Per Capita Tax Payment along Ratio between Land Area and Household Size 153
3.11 Natural Disaster and Treatment status 154

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CHAPTER 1

The Residential Choice of Adult Children: Competition between Parents and Parent-in-Law

1.1 Introduction

The aging of the population, due to increasing life expectancy and declining fertility, raises a number of difficult policy issues for countries going through this demographic transition. Many of these countries have not yet developed sufficient elderly care facilities and programs, and families remain as the basis of elderly support. The phenomenon is particularly prominent in Eastern Asian context where because of the 'filial piety' culture, the state governments, for a long time, regarded families as the major provider of elderly welfare and public services as merely supplementary.[1] For family members, care-giving is time-consuming, and geographic proximity between care-givers and care-recipients may greatly improve the welfare of both.[2] Against this background, I endeavor to understand the decision process surrounding the residential choice of adult children.

I start with the idea that for young couples parents and parents-in-law might play strategically to influence their locational choices. The geographical distances between couple's location and their parents/parents-in-law's homes are important determinants for the cost of providing attention and care, and thus the potential amount of family visits and time transfers that elder generation receives. Therefore with both parents and parent-in-law valuing care from children, the elder generation enter into an auction to bid for the proximity of the couple. Meanwhile, husband and wife have their own individual preferences, and each is altruistic with respect to their own parents, but not their parents-in-law. In this case, absent of bidding from parents/parents-in-law, the couple's joint utility maximization will result a locational choice closer to the parents of higher-

[1] See for example Chao and Roth (2005), and Chen (2007).
[2] See for example Stern (1995)

bargaining-power individual. Thus the bargaining power of the children within their own marriage partly determines the amount that parents' must pay to win this auction: the higher bargaining power of a child, the "cheaper" to win the couple to parents' place of residence.

In this paper, I study both theoretically and empirically this strategic incentive of parents and parents-in-law and the resulting equilibrium location of the couple. My theoretical model consists of a three-stage game in which the players are the husband, the wife, the husband's parents and the wife's parents. In the first stage, the husband's and wife's parents decide simultaneously on the maximum amount of subsidy they are willing to offer to the couple. In the second stage, the couple chooses their location after observing offers from both sides. In the third stage, parents initiate the transfers based on both their announcements in the first stage and couple's locational choice while the couple provides attention and care to their parents. Here, the residential choice of adult children is modeled in the context that recognizes not only the cost of providing care, but also the bidding competition between parents and parents-in-law.

The full characterization of all subgame-perfect equilibria in pure strategies leads to several interesting testable implications. As a benchmark, I first characterize the equilibrium locational choice of single children. Lacking the incentive from parents-in-law, single children, regardless of their gender, prefer to live as close as possible to their parents. I then analyze the decision process for married couples. I show that in equilibrium, the couple is more likely to live close to parents of the individual with higher bargaining power within marriage. A key insight here is that children have different price tags for their proximity to parents due to their bargaining power, and parents are more willing to bid for the "cheaper" children. Therefore, the equilibrium location outcome would be that "cheaper" children live closer to their parents than more expensive ones. Finally, the locational choices of married children are also influenced by parental characteristics. A married child would locate closer if parents have higher valuation in co-residency and they are wealthy enough to outbid parents-in-law. In contrast, similar arguments do not apply to single children.

Then I test the predictions of theoretical framework using the Surveys of Health and Living Status of the Elderly in Taiwan (HLSET) Panel. The empirical results demon-

strate that single children live significantly closer to their parents than do married children. Moreover, there is no obvious gender difference in the living arrangements among single children. I also find that married females live much further away to their parents than married males. Given the evidence[3] that males, on average, have higher bargaining power within marriage than females, these results are strong supports of theoretical predictions. In addition, empirical results for matched couples, sibling composition and downward transfers provide further evidences to confirm the arguments.

There exist an extensive literature on the family locational pattern and intergenerational transfers, and numerous studies confirm that intergenerational proximity greatly facilitates frequent contacts and care between generations.[4] This paper is related to this literature but does not directly contribute to it. While much is known about intra-family resource allocation taking the "geography" of family as given, most studies ignore the question of why we observe such "geography" of family in the first place. In contrast, I am interested in the underlying mechanism and determinants of the residential choice of adult children, while taking the positive relationship between proximity and contacts as granted.

Perhaps a more direct link can be drawn between this paper and the research focusing on the locational choices of young couples. Early literature on this topic mainly emphasizes the influence of human capital and the labor market in the decision process.[5] More recently, several papers make an effort to place the locational choice of young couples in an intergenerational context. For example, Compton and Pollak (2009) find that on average, married women in the United States live closer to their mother than married men. In contrast, with Norwegian registry data, Loken *et al.* (2011) show that married men live significantly closer to their own parents than do married women and this difference cannot be easily explained by differences in observed characteristics. This result is similar

[3]See for example Lee (1994), Berik *et al.* (2004), Seguino (2002) for more details.

[4]For references see Lawton *et al.* (1994) and Greenwell *et al.* (1997). For comparative studies see Hank (2007) and Bordone (2009).

[5]For example, in his pioneer work, Mincer (1978) pointed out that family ties tend to deter migration. In particular if wives are secondary earners of the family, they may experience reduced employability and earnings when family tries to maximize the total earnings. Costa and Kahn (2000), on the other hand, proposed the idea of "power couple". They argued that educated couples are increasing locating in large metropolitan areas since it is easier to find two jobs commensurate with the skills of each spouse. Compton and Pollak (2007), however, find no support for this hypothesis using PSID data. Instead, they argued that the location patterns are better explained by the higher rate of power couple formation in larger metropolitan areas.

to what I find in this paper. However, most papers fail to offer a coherent explanation of the observed pattern, let alone a formal theoretical framework. This paper, on the other hand, bridges two strands of the literature by proposing a new explanation in the residential choice of adult children and explicitly modeling this decision process. To my knowledge, this is the first paper to formalize the idea that parents and parents-in-law play strategically to influence the locational decision of the young couple.

The theoretical framework of this paper benefits greatly from the research on strategic behaviors among siblings. Konard *et al* (2002) have developed a model to characterize the idea that in the families with two children, the first-born child may strategically move far away from parents, forcing the younger child to locate next to the parents and thus providing all or most of the elderly care to their parents. In contrast, Rainer *et al* (2009) study the interaction between parental care responsibilities, family structure and children's mobility characteristics. They argue that relative to the only children, children with siblings have higher rates of mobility and better labor market outcomes due to the presence of an alternative potential care-giver. My paper extends their theoretical framework by including elder generations as strategic players.[6] I believe this is a natural extension that better characterizes the decision process within the family.

In addition, this paper also relates to literature on auctions of divisible goods. Pioneered by Wilson (1979), "share" auctions gain much attention[7] in the theory field where the bidders receive fractional shares of the item as opposed to ordinary "unit" auctions. Bidder behaviors may be considerably different as their strategy space is augmented by the quantity they acquire in addition to the price they pay. While this setup is widely used in theoretical studies of markets for houses, bonds, electricity, IPOs etc, its applications in applied literature are rare. This paper makes an effort to incorporate the idea by introducing an auction between parents and parents-in-law with the proximity of the couple being the divisible goods.

The paper proceeds as follows. Section 1.2 develops the theoretical framework and derives the testable implications of the model. Section 1.3 describes the data and confronts the theoretical implication with data. Section 1.4 points out possible complications and

[6]Rainer*et al.*(2009) treats parents as entirely passive. Konard *et al.*(2002) include a stage where parents can decide whether to move closer to their children. But there is no strategic element in the decision.

[7]See for example Back and Zender (1993), and Cramton and Ausubel (2002).

alternative explanations of the empirical results. Section 1.5 discusses policy relevance of the findings in this study and concludes the paper. All the technical proofs are in the Appendix.

1.2 Theoretical Framework

Consider the following family that consists of a married couple, husband (H) and wife (W), husband's parents (P_H) and wife's parents (P_W). The places where husband's parents (P_H) and wife's parents (P_W) live and raise their children are normalized to 0 and c respectively. The residential location of both P_H and P_W are interpreted as points in the two-dimensional plane or on the real line, as only distance matters here. The model consists of three stages with complete information.

Stage 1: The 'Subsidy Game'

When husband and wife get married, they need to make a relocation choice. With both husband's parents P_H and wife's parents P_W value the proximity of the couple, they enter an auction where both of them simultaneously announce the maximum amount of subsidy I_H and I_W (in the whole dollar amount) they are willing to provide to the new couple to compensate for the relocation expenses. Note that this model does not differentiate in-kind subsidy (e.g. provide housing directly or a promise for future time transfers) and the actual monetary subsidy. Parents care about their own consumption as well as the amount of care they receive from the couple, which critically depend on the distance between parents and the couple. Let G_i be the total units of care[8] that parents P_i receive, T_i be the actual transfer amount from P_i to the couple[9] in the third stage and y_i be the total wealth (in the whole dollar) of $P_i, i \in \{H, W\}$. Also, let $\underline{c_i}$ (in the whole dollar[10]) be the subsistence level of consumption of P_i. The objective function is assumed

[8] G_i can be broadly interpreted as any transfer from couple to parents whose costs are related to the distance. More discussions will be presented in section 1.2.3.

[9] T_i is a function of parents' announcement I_i and the couple's location choice in the second stage. More details will be given in the description of the third stage of the game.

[10] Here I assume I_i,y_i and $\underline{c_i}$ to be the whole dollar amount to avoid the explicit specification of tie-breaking rule in the equilibrium analysis. The arguments and conclusions remain the same if we remove this assumption as long as appropriate tie-breaking rule that guarantees the existence of equilibrium is chosen.

to be quasi-linear:

$$(1) \qquad U^{P_i} = y_i - T_i + u_i(G_i), \quad i \in \{H, W\} \quad s.t. \quad y_i - T_i \geq \underline{c_i}, T_i \geq 0$$

where $u_i' > 0, u_i'' < 0$ and $lim_{G_i \to 0} u_i'(G_i) = \infty$. Note that P_H and P_W may derive different utilities from same amount of cares received, as this preference of attention may vary with parental characteristics and needs. Moreover, I assume that the consumption level of P_i cannot be below the corresponding subsistence level and their transfers to the couple cannot be negative.

Stage 2: The 'Location Game'

After observing offers I_H and I_W from both sides, the couple makes their locational choice l in the two-dimensional plane. Two mechanisms in the third stage make any choice of l other than the points on the line segment $[0, c]$ suboptimal: first the actual transfers T_i that couple receives decrease with respect to the distance between the couple and P_i; second the cost of care that the couple provides increases with respect to this distance. Hence, with locational choice l the distance between the couple and P_H, P_W can be characterized as l and $c - l$ respectively.

Stage 3: The 'Care-giving Game'

In this stage, parents initiate transfers of subsidies to the couple[11] after observing couple's locational choice in stage 2. Also I assume linear bidding functions[12] for P_H and P_W where the actual transfer amount T_i or the bid is a decreasing function of the distance between the couple and $P_i, i \in \{H, W\}$. This reflects the punishment to the couple who moves away.

$$T_H = (1 - \frac{l}{c})I_H, \quad T_W = \frac{l}{c} I_W$$

[11]The implicit assumption here is that parents have no incentive to deviate from their announcements in stage 1 because of reasons such as social pressure or potential punishments from children. More discussions can be found in section 1.2.3.

[12]Presumably such linear bidding functions may not be optimal. However, to my knowledge, the divisible goods auction literature normally either makes such assumptions directly or assumes for reverse engineers preferences that makes linear bidding functions optimal. In general, the exact forms of optimal bidding functions are not clear and in most cases infinite-dimensional bidding functions would not be tractable.

Meanwhile, husband and wife decide simultaneously on their units of care to parents and private consumption conditional on their locational choice in the second stage. Following Konard *et al.* (2002), the time cost per unit of care consists of one unit of time actually spent with the parents, plus the travel time (by appropriate normalization) that is equal to the distance between couple's place of residence and the corresponding parents' location. Denote g_{ij} as the units of cares from individual i to parents P_j where $i, j \in \{H, W\}$. Also assume that both husband (H) and wife (W) are endowed with fixed time budget m that can be allocated between market activities x_i that yield private consumption and cares, then:

$$(2) \qquad m = x_i + (1 + l)g_{iH} + (1 + c - l)g_{iW}, i \in \{H, W\}$$

For parents P_j, cares from husband and those from wife are assumed to be perfectly substitutable. Denote G_j as the total units of care that P_j receives, then:

$$(3) \qquad G_j = g_{Hj} + g_{Wj}, j \in H, W$$

When making their simultaneous decisions in this stage, individual i only cares about his/her private consumption level and total units of care G_i that his/her own parents receive. The utility function for individual i with consumption level c_i is assumed to be:

$$U^i = \beta log(c_i) + (1 - \beta)log(G_i), i \in \{H, W\}$$

where $\beta \in (0, 1)$.

The total income of the couple consists of their wage income from market activities along with transfers from both parents. The couple pools their resources together and thus the budget constraint has the form

$$(4) \qquad c_H + c_W = w_H x_H + w_W x_W + (1 - \frac{l}{c})I_H + \frac{l}{c}I_W$$

where w_H and w_W are the wage rates for husband and wife respectively.

Finally, following the usual assumptions of collective models (Chiappori (1988) and (1992), Blundell *et al.* (2005)), I assume Pareto-efficiency in couple's joint decision pro-

cess. This is equivalent to assume that household allocations are determined as solutions to the problem

$$(5) \qquad \max_{c_H, c_W, g_{HH}, g_{HW}, g_{WH}, g_{WW}} U^{couple} = \alpha U^H(c_H, G_H) + (1-\alpha)U^W(c_W, G_W), \quad \alpha \in [0,1]$$

subject to the overall budget constraint (4). The Pareto-weight α reflects the relative bargaining power of husband in the household. Without loss of generality, I assume that $w_H > w_W$ throughout the paper. As a benchmark, I investigate the situation with a single child first before proceeding to the full characterization of the subgame-perfect equilibrium of the model.

1.2.1 Single Child

Intuitively, a single child has no spouse to contribute to the elderly care or private consumption and derives no utility from caring parents-in-law. Hence he/she has the incentive to minimize the travel cost of the care to his/her parents by locating as close as possible to the parents' place of residence. Formally suppose that after the second stage the single child S locates at l with parents' location being normalized to 0. By the assumption of utility function, an interior exists and can be characterized by the first order condition:

$$(6) \qquad (1-\beta)c = \beta w G(1+l)$$

where w is the wage rate, c is the private consumption level of the child and G is the total units of cares that parents receive.

In the second stage, child S decides on the location l. By the condition (6) and his/her budget constraint, the first order condition with respect to l has the form

$$\beta \frac{1}{c}\frac{\partial c}{\partial l} + (1-\beta)\frac{1}{G}\frac{\partial G}{\partial l} = -w\beta\frac{G}{c} + T'(l) < 0$$

Therefore, regardless of parents' choice in stage 1, a choice $l = 0$ would always be optimal for the single child, which further induces $I = 0$. This result is as expected since parents face no competition from parents-in-law for care. To summarize, the model predicts that a single child has the incentive to live as close as possible to his or her parents, regardless

of the transfers provided by the parents. Meanwhile, parents do not have to use subsidy to strategically influence the locational choice of their single children.

This model only captures one out of many different dimensions that might affect the mobility patterns of single children. Other factors, particularly employment opportunity that has been extensively studied in Rainer *et al.* (2009), might induce single children to migrate away from parents' place of residence. However, as a benchmark, the characterization of the equilibrium clearly reveals that parents have no reason to play strategically to influence single children's locational choices due to the lack of competitors. This is very different under the situation for married children.

1.2.2 Married Couple

Consider now the joint location decisions of married couple, for whom locational choice presents a potential conflict. I solve the subgame-perfect equilibrium with backward induction, starting from the third stage.

LEMMA 1: *Assume that $w_H > w_W$. Then the equilibrium*[13] *of care-giving game in stage 3, conditional on locational choice of l in stage 2, is characterized by*

$$
\begin{aligned}
&g_{HH} = g_{HW} = 0 \\
&c_H = (A + (1 - \frac{l}{c})I_H + \frac{l}{c}I_W)\alpha\beta, \quad c_W = (A + (1 - \frac{l}{c})I_H + \frac{l}{c}I_W)(1-\alpha)\beta \\
&G_H = g_{WH} = \frac{(A + (1 - \frac{l}{c})I_H + \frac{l}{c}I_W)\alpha(1-\beta)}{w_W(1+l)} \\
&G_W = g_{WW} = \frac{(A + (1 - \frac{l}{c})I_H + \frac{l}{c}I_W)(1-\alpha)(1-\beta)}{w_W(1+c-l)}
\end{aligned}
$$

where $A = w_H m + w_W m$

The proof is in the Appendix. First, for any arbitrary $w_H > w_W$, the full amount of elderly care is entirely provided by wife. This can be readily expected as the cares

[13]The implicit assumption here is $G_H + G_W \leq m$. The subsidy choice I_H and I_W such that $G_H + G_W > m$ is never optimal. In terms of subgame-perfect equilibrium of the game, imposing fixed time budget m is equivalent of imposing corresponding upper bounds for I_H and I_W. The characterization of the equilibrium remains unchanged. More details are available upon requests.

from husband and those from wife are perfectly substitutable and husband bares higher opportunity cost. As a result, husband would merely focus on the market activities that yield private consumption to maximize their joint utility. Second, total transfers to parents decrease with respect to the distance between couple's location and parents' place of residence. This captures the basic idea that distance is a key determinant for the cost of providing attention and care. Third, for given locational choice, care units received by P_i is proportional to the bargaining power of the corresponding individual. For example, in the extreme case where $\alpha = 1$, couple would devote all the care units to husband's parents while wife's parents receive zero.

Turning to stage 2, the couple observes the offers I_H and I_W from both parents and decides on their location of residence. Formally, the equilibrium location in this stage can be characterized by Lemma 2. To suppress the notation, I use w instead of w_W for the rest of the paper.

LEMMA 2: *Given subsidy amounts I_H and I_W in stage 1, the equilibrium of location game in stage 2 can be characterized by the following conditions:*

(i) *If* $\frac{A+I_H}{A+I_W} > (1+c)^{(1-2\alpha)(1-\beta)}$, *then the equilibrium location is* $l = 0$

(ii) *If* $\frac{A+I_H}{A+I_W} < (1+c)^{(1-2\alpha)(1-\beta)}$, *then the equilibrium location is* $l = c$

(iii) *If* $\frac{A+I_H}{A+I_W} = (1+c)^{(1-2\alpha)(1-\beta)}$, *then the couple is indifferent between* $l = 0$ *and* $l = c$,*and the equilibrium location can be characterized as*
$l = p \cdot 0 + (1-p) \cdot c, p \in [0,1]$

A formal proof is in the Appendix. The equilibrium described in Lemma 2 indicates that the present framework points to a sharp distinction between the optimal actions of single children and that of the couples. First of all, the very existence of an alternative subsidy provider enables the couple to extract higher subsidy amount by threatening to move further away, and hence to potentially decrease provided cares. It is as if P_H and P_W enter an auction and compete in their bids to 'bribe' the couple so as to influence who 'get the attention and care' at later stages. Moreover, children's bargaining power within their own marriage is crucial in this auction with parents competing against parents-in-law.

For example, consider the scenario that husband has a higher bargaining power compared to wife, that is $\alpha > 1/2$. With $(1+c)^{(1-2\alpha)(1-\beta)}$ less than one, P_H has relative advantages in the sense that a higher bid than P_W is not necessary for successfully 'bribing' the couple to locate in their place of residence. In another word, children with higher bargaining power are cheaper to 'bribe' from parents' perspective.

Continuing the backward induction, the next step would be to fully characterize all the subgame-perfect equilibria. I postpone this, however, to define a critical subsidy amount of P_W that is important for characterizing P_H's subsidy choice. First, I assume[14] that $u'_H(\frac{A\alpha(1-\beta)}{w}) < \frac{w}{\alpha(1-\beta)}$ with $\frac{A\alpha(1-\beta)}{w}$ being the units of care provided to P_H when the couple co-resides with P_H but receives subsidy from neither side. Particularly, this assumption guarantees that P_H's utility strictly decreases with respect to the subsidy amount I_H as long as the couple resides at $l = 0$. That is, the income effect for the couple is not too strong and the only incentive for P_H to increase subsidy amount is to outbid P_W and thus to influence couple's location of residence.

In the first stage, given P_W's subsidy choice I_W, P_H anticipates the location and family transfer choice of the couple at later stages and acts optimally. Let K_2 to be the largest integer value such that

$$y_H + u_H(\frac{(A+K_2)\alpha(1-\beta)}{w(1+c)}) \leq y_H - I_H + u_H(\frac{(A+I_H)\alpha(1-\beta)}{w}) \quad (\dagger)$$

where $I_H = max\{\lceil (A+K_2)(1+c)^{(1-2\alpha)(1-\beta)} - A \rceil, 0\}$ and $\lceil K \rceil$ is the smallest integer not less than K.

PROPERTY 1:*Such K_2 exists and is unique with $K_2 \geq 0$.*

The proof is in the Appendix. Conditional on P_W's subsidy choice I_W, P_H has two relevant alternatives. First, P_H can choose I_H high enough to outbid P_W and earn the utility on the right-hand side of (†). In this alternative, by above assumption P_H would only be willing to offer the minimum amount of subsidy that can 'bribe' the couple to their place of residence. Second, P_H can decide to give up outbidding P_W and be satisfied

[14]This is not a strong assumption. For example, under the log utility, the inequality would hold as long as $A = w_H m + w_W m > 1$.

with the couple living away. In this alternative, P_H would prefer to bid as high as possible to induce an even higher bid from P_W, and thus reap a higher utility.

P_H's choice of subsidy depends crucially on P_W's decision. In particular, the critical subsidy amount K_2 defined above specifies a threshold of trade-off that P_H faces. On one hand, 'bribing' the couple to locate at $l = 0$ has the benefits of decreased travel cost, and thus increased attention and care from the couple. However, if the bid from P_W is too high, the disutility of outbidding P_W to ensure a locational choice $l = 0$ will outweigh the utility brought by increased family transfers. Under this situation, P_H is better off by yielding to P_W and letting the couple locate at $l = c$ instead. Therefore, to characterize P_H's decision, we need to distinguish between three cases, namely whether I_W is smaller than, equal to, or greater than K_2. Assume first that there exists the integer value K_2 such that the expression (†) holds with equality. If $I_W < K_2$, P_H prefers to choose I_H high enough to outbid P_W. If $I_W = K_2$, P_H is indifferent between these two alternatives. Finally if $I_W > K_2$, P_H strictly prefers the couple to stay at P_W's place of residence. On the other hand, if the expression (†) only holds with strict inequality, we can combine the first two cases where P_H always prefers to outbid P_W in this auction.

Similarly, I can define a critical subsidy amount of P_H to characterize P_W's decision in the first stage. Again, I impose an upper bound for the marginal utility of P_W for care when couple co-resides with P_W but receives subsidy from neither side, *i.e.* $u'_W(\frac{A(1-\alpha)(1-\beta)}{w}) < \frac{w}{(1-\alpha)(1-\beta)}$. Then I define K_1 to be the largest integer value such that

$$y_W + u_W(\frac{(A+K_1)(1-\alpha)(1-\beta)}{w(1+c)}) \leq y_W - I_W + u_W(\frac{(A+I_W)(1-\alpha)(1-\beta)}{w}) \quad (\ddagger)$$

where $I_W = \lceil (A+K_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil$. By the same arguments as in Property 1, K_1 exists and is unique with $K_1 \geq 0$. Moreover, K_1 can be similarly interpreted as the threshold of I_H above which P_W is willing to yield to P_H in the auction and be satisfied with couple's locational choice $l = 0$.

Let us now turn to the subgame-perfect equilibrium choice in the first stage. To avoid parents' consumption level being below their corresponding subsistence level in any case, I impose the conditions that $I_H \leq y_1 - \underline{c_1}$ and $I_W \leq y_2 - \underline{c_2}$. To suppress the notation, I write these two upper bounds as B_1 and B_2 respectively where $B_1 = y_1 - \underline{c_1}$ and $B_2 = y_2 - \underline{c_2}$. Then the equilibrium location of the couple is characterized by the

following Proposition.

PROPOSITION 1: *Assume that there exist integers K_1 and K_2 such that (†) and (‡) hold with equality,*[15] *and $\lceil (A+K_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil < K_2$. Then the subgame-perfect equilibrium location choice can be characterized as follows:*

- *if $B_1 < K_1$ and $\frac{A+B_1}{A+B_2} < (1+c)^{(1-2\alpha)(1-\beta)}$, the equilibrium location of the couple is $l = c$.*
- *if $B_1 \leq K_1$ and $\frac{A+B_1}{A+B_2} = (1+c)^{(1-2\alpha)(1-\beta)}$, the equilibrium location of the couple is $l = p \cdot 0 + (1-p) \cdot c$ with $p \in [0,1]$*
- *if $B_1 = K_1$ and $\frac{A+B_1}{A+B_2} < (1+c)^{(1-2\alpha)(1-\beta)}$, the equilibrium location of the couple is $l = p \cdot 0 + (1-p) \cdot c$ with $p \in \{0,1\}$*
- *for all other cases, the equilibrium location of the couple is $l = 0$*

A detailed characterization of the subgame-perfect equilibrium choices and a formal proof are in the Appendix. Figure 1.1 illustrates graphically the equilibrium choice of location with $\alpha > \frac{1}{2}$. These locational choices have a simple intuition. As argued above, the value of K_1 measures the willingness of P_W to trade downward subsidies for attention and care from the couple. A small K_1 indicates low valuation of P_W for co-residing with the couple. Similar arguments apply to the interpretation of K_2. Hence the relationship $\lceil (A+K_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil < K_2$ reveals that P_H values co-residency more than P_W in the relative sense and thus is less likely to compromise in the auction. Consider now the case that $\frac{A+B_1}{A+B_2} < (1+c)^{(1-2\alpha)(1-\beta)}$. In theory, P_W is wealthy enough to outbid P_H and to ensure an equilibrium locational choice $l = c$ of the couple for any bid I_H. However, by the assumption, their disutility of outbidding P_H would soon outweigh the benefit while co-residency with the couple remains favorable for P_H. Therefore, despite of their capability, P_W would only choose to outbid P_H if I_H is not too high, *i.e.* $I_H < K_1$, which results $l = c$. The argument shares the same spirit for the situation that

[15] The conclusions and proofs are extremely similar for the cases where (†) or (‡) hold with strict inequality. The detailed arguments are available upon request.

$\frac{A+B_1}{A+B_2} > (1+c)^{(1-2\alpha)(1-\beta)}$. Now P_H has sufficient resources to outbid P_W in any case. Moreover, P_H has a relatively higher valuation for co-residency than P_W. Therefore, P_W would always underbid in the auction which results an equilibrium location $l = 0$.

Then consider the situation with $\lfloor (A+K_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rfloor > K_2$, that is, P_W has a relative higher valuation for co-residency than P_H. Here, the argument follows the same logic as above. With $\frac{A+B_1}{A+B_2} < (1+c)^{(1-2\alpha)(1-\beta)}$, P_W has both the capability and desirability to outbid P_H in the auction. This leads to a residential choice of $l = c$ for the couple. In contrast with $\frac{A+B_1}{A+B_2} > (1+c)^{(1-2\alpha)(1-\beta)}$, despite the fact that P_H is wealthy enough to ensure a locational choice $l = 0$ of the couple, they are willing to do so only if the bid I_W is not too high. More specifically:

PROPOSITION 2: *Assume that there exist integers K_1 and K_2 such that (†) and (‡) hold with equality, and $\lfloor (A+K_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rfloor > K_2$. Then the subgame-perfect equilibrium location choice can be characterized as follows:*

- *if $B_2 < K_2$ and $\frac{A+B_1}{A+B_2} > (1+c)^{(1-2\alpha)(1-\beta)}$, the equilibrium location of the couple is $l = 0$.*
- *if $B_2 \leq K_2$ and $\frac{A+B_1}{A+B_2} = (1+c)^{(1-2\alpha)(1-\beta)}$, the equilibrium location of the couple is $l = p \cdot 0 + (1-p) \cdot c$ with $p \in [0,1]$*
- *if $B_2 = K_2$ and $\frac{A+B_1}{A+B_2} > (1+c)^{(1-2\alpha)(1-\beta)}$, the equilibrium location of the couple is $l = p \cdot 0 + (1-p) \cdot c$ with $p \in \{0,1\}$*
- *for all the other cases, the equilibrium location of the couple is $l = c$*

The proof follows the same logic as that of Proposition 1 and is available upon request. Figure 1.2 illustrates graphically the equilibrium choice of location with $\alpha > \frac{1}{2}$. The full characterization of the subgame-perfect equilibrium uncovers a stark distinction in location patterns with respect to children's marital status. The basic insight of theoretical framework is that single children would locate as close as possible to their parents while married children have incentives to move away in some cases. Moreover, the characterization of equilibrium indicates that single children's location patterns are independent

of their gender. These observations lead to the first hypothesis regarding the empirical results.

PREDICTION 1: *Single children on average locate much closer to their parents than married children. Also there should be no gender difference in the location pattern among single children.*

The location patterns of married couples are also closely related to children's bargaining power within their own marriage. Although above theoretical framework fully characterizes the locational choices of children with different bargaining powers, unfortunately, lack of key information in the data set[16] prohibits further structural estimation of the model. Therefore, I take a step back and consider testable implications of children's residential choices. Consider a simple example where parents have two married children: child A and child B who have relatively high and low bargaining power within their marriage respectively. Assume further that child A's and child B's parents-in-law would offer the same amount of subsidies. Then the characterization of equilibrium clearly indicates that parents prefer to bid for child A since his/her associated price is much lower. In general, the theoretical framework demonstrates that each child is associated with a price tag that is partly determined by their bargaining power. With multiple potential married care donors, parents would start bidding from "cheapest" child, that is, child with highest bargaining power within marriage. Hence the equilibrium location would be that distance between parents and children decreases with respect to children's bargaining power. Therefore the well-established evidences[17] that males on average have higher bargaining power than females in Taiwan lead to the second empirical prediction.

PREDICTION 2: *Married males on average locate closer to their parents than married females.*

[16] As most of the data sets, the panel data in this paper lacks crucial information about parents-in-law. Detailed description of the data set can be found in section 1.3. Hence the main focus of empirical part of this paper is to examine testable implications derived from theoretical framework and I will leave the structural estimation to future work.

[17] See Lee (1994), Berik *et al.* (2004), Seguino (2002) for references.

The graphical portrayal of the equilibrium also reveals that single children and married children respond quite differently to variables that measure parental preference and wealth. Single children always locates as close as possible to their parents to minimize the travel costs, regardless of parents' valuation of co-residency and wealth. In contrast, those factors would greatly influence locational choices of married children. Specifically, both parents' strong favor for co-residency and their wealth significantly increase parents-in-law's difficulty of winning in the auction. In another word, parents-in-law are more likely to underbid which results children locating close to their parents. The arguments are summarized in the third empirical hypothesis.

PREDICTION 3: *The location patterns of the married children respond more to the parental characteristics and preferences than single children.*

1.2.3 Discussion

Before proceeding to the empirical analysis, I would like to discuss some assumptions and possible generalizations of the model. First, the current framework assumes that adult children make their location decision in anticipation of future care-giving responsibilities. Two reasons make me believe that this is a reasonable assumption. First, numerous papers[18] document that residential mobility tends to be highly concentrated in younger ages and mobility costs may be prohibitively high at later years. This is the case because individuals may have established social networks in the local area, built up job-specific or firm-specific human capital, invested in housing and their children may be settled in a perfect school. Hence when making choice of residence, the cost of relocation may force adult children to take elderly care into consideration even years before the problem becomes relevant. The evidence in the panel data supports this assumption. During the survey period from 1989 to 1996, 79.7% of the adult children in my sample remain in the same distance category from parents in which they were originally observed. Similarly, children's current co-residency status seems to be a particular good indicator for past or future co-residency decisions. The survey directly interviewed 576 currently co-residing children and 1455 non-coresding children over age 35. 91.2% of the former indicate that

[18]See for example Groot and Verberne (1997).

they have always lived with parents and 95% of them have no future plan to separate from parents. Meanwhile, only 4% of the latter ever moved back to parents' household for a period over four months after they first moved out of parents' household. In addition, parents rarely change their location of residence at later years. The average age at which parents moved into their current place of residence is 36.3 and 80.4% of parents moved to their current residence before their children turned 35. Formally, the summary statistics in section 1.3 indicate that parents are quite old in my sample. Hence, for majority of children, their current location is closely related to a problem that is already relevant or will become relevant in the immediate future.

Second, in reality intergenerational transfers always occur in multiple periods. To better capture this fact, the current theoretical framework can be generalized as a repeated game wherein the intuition and the structure of the equilibrium remains qualitatively unchanged. However one implicit assumption of the extension is that the both parents and children could make binding commitments. This assumption is plausible in current context since there are several mechanisms by which intergenerational agreements may be self-enforcing within family. First, in the environment with repeated interactions, both parents and children can play a trigger strategy[19] and punish the opponent if a certain level of defection is observed. Second, numerous studies[20] have shown that children's deviation from elderly care duty is particularly worrisome. This problem may not be prominent in Eastern Asia context where the culture norm and social/legal pressure[21] greatly increases parents' ability to contract over children's future behavior.

Third, the current model labels G_i as care units that children provide to parents and I_i as promised downward subsidies. However, with appropriate adjustments and interpretation, this framework can incorporate a wide range of characterization regarding intergenerational ties. First, I_i can be interpreted as parents' promises of any immediate or future time or monetary transfers. Such transfers might cover major gift to children for relocation compensation or commitments to take care of grandchildren. Par-

[19]For example, parents might condition the division of bequests on the beneficiary's actions (Bernheim *et al.* (1985)) whereas children could punish the parents by providing no care if parents deviate from their promise of transfers.

[20]See for example Bengtson *et al.* (1971)

[21]As Chen (2007) pointed out "filial piety has always been essential for this society, and adult children share the obligation of taking care of senior members within the family. The case is especially so in Taiwan where numerous legislations, such as Civil Law and Senior Citizens' Welfare Act, regulates children's 'elderly maintenance duty' and draws up punishments in order to prevent elderly desertion."

ticularly, I_i could include promise regarding parents' bequeathable wealth. Hence, this framework expands on the original Bernheim *et al.* idea by hypothesizing that both parents and parents-in-law could potentially condition the division of bequests on children's locational choices. Second, current theoretical framework treats the total units of care that parents receive as the simple summation of units from husband and from wife, i.e. $G_j = g_{Hj} + g_{Wj}$. This production function can be generalized to address several potential extensions. For example, we could argue that parents and parents-in-law bid not only for children's attention and care but also the access to grandchildren. To partially characterize parents' contacts with grandchildren, we may consider a production function $G'_j = (g_{Hj} + g_{Wj})(1 + f(n))$ with n being number of children that couple has, $f'(n) > 0$ and $f(0) = 0$. This specification would cause an equilibrium in which children with more offspring live closer to their parents. This is against the prediction that single children live closer to parents than married children since out of wedlock births were extremely rare during the period of study in Taiwan. However, the conclusions regarding gender difference remain qualitatively the same. The empirical implications will be discussed more in section 1.4. Finally, although G_i is labeled as care units, the framework can also take monetary support from children to parents into account. We could imagine that physical closeness builds emotional intimacy which leads to higher level of monetary or in-kind transfers. Hence the probability that parents receive any monetary gift from children may also decrease with respect to their distance, albeit at a much slower rate compared to time transfers. The summary statistics from the panel data confirms this pattern.[22] Moreover, from theoretical point of view, the strategic incentives of parents and parents-in-law are even stronger if children's giving of money and time are complements. This seems to be the case as the probability that parents receive time and money transfers are positively correlated[23] in the data. Couch *et al.* (1999) also provide some empirical evidence that time and money may be complements. Hence the equilibrium results are qualitatively robust with respect to the generalization to monetary transfers.

Fourth, children may differ in their preference regarding parental care. The potential variation of parameter value β could partly capture this concern. Intuitively, children

[22]The correlation between whether parents receive any monetary transfers and distance category is -0.1458 while the corresponding correlation for time transfer is -0.3194. Both numbers are significant at 1% level.

[23]The correlation between this two probabilities is 0.1285 and it is significant at 1% level

with higher preference for parental care would locate closer to their parents. The characterization of the equilibrium confirms this intuition by predicting that a smaller value of β would increase the likelihood of children co-residing with their parents. Furthermore, the current framework assumes the same level of preference over their own parents for husband and wife. This assumption can be easily removed by allowing different β values in their corresponding utility. Now the refined equilibrium location choice[24] has a simple intuition: both individual bargaining power and the couple's potentially different preferences regarding parental care would affect the location pattern. If a couple's preferences do not differ much, they would display an equilibrium behavior similar to the one in the baseline model. However, if the asymmetry in preference within a couple is sufficiently large, more caring individual would dominate their locational choice despite that he/she may have a lower bargaining power. These discussions of heterogeneous preference may have important empirical implications but impose difficult questions as well. I will further elaborate in some of theses issues in section 1.4.

1.3 Empirical Analysis

I test the theoretical predictions of my model using the data sets from the series of Surveys of Health and Living Status of the Elderly in Taiwan (HLSET). The HLSET is a large representative panel data for the population beyond age 60, living both in private households and government-supported facilities. The survey began in 1989 with the original sample ($n = 4,089$) being selected based on stratification by administrative units, education level and total fertility rate. In 1996, to deal with the shrinking sample size due to deceased observations, the original panel sample comprised of individuals who were then age 67 or older ($n = 2,669$) was supplemented with a new representative sample ($n = 2,462$) of individuals who were 50 to 66 years old. The survey follows the sample through multiple waves of information collection and now data for the first three waves (1989, 1993 and 1996) is publicly available.

The survey were designed to understand the appropriate measurement and the causal

[24] Assume that the parameter values for husband and wife are β_1 and β_2 respectively. Then the new equilibrium locational choice can be similarly characterized by original results, with $(1+c)^{(1-2\alpha)(1-\beta)}$ being substituted by $(1+c)^{((1-\alpha)(1-\beta_2)-\alpha(1-\beta_1))}$. The proofs largely remain the same. More details are available upon requests.

mechanisms involved in health and well-being of the elderly in Taiwan. Special attention is given to policy-related information of the elderly generation, such as their living arrangements, medical care, health behavior and financial status. In particular, elderly respondents were asked to identify their social networks and social exchanges with all the potential care-givers (including both family member and non-family member). These data enable me to construct a rich intergenerational panel data set including various information about all the respondents' children, such as their demographic characteristics, residential distance and intergenerational transfers with parents. Moreover in the 1993 wave, HLSET directly interviewed a subsample of respondents' children and daughters-in-law. I use this additional information first to cross-verify elderly interviewees' responses in the main survey, and second to match the observations of husbands and wifes, which I will explain in a greater detail in section 1.3.2.

I restrict my attention to the married or single children over age 35.[25] The rationale for this requirement is that children above this age have already had the chance to make their marriage and locational choices,[26] so that the observed living pattern can be interpreted as the decision process discussed above. Specifically, I exclude the children who are divorced, widowed or currently separated since these situations are likely to provoke a relocation decision or other potential complications. Then follow Rainer *et al.* (2009), I require that all the adult children had finished their education and they are not in the military service. This is mainly to avoid the complication that most of them are categorized as co-residing children in the survey, although in reality, they are completely different from other cohabiting children who assume much burden of the elderly care. After pooling together all the observations from three waves and exclude observations with missing location information, the final sample includes 35,117 child-year observations, among which 1,250 are single males, 696 are single females, 16,437 are married males and 16,734 are married females.

Table 1.1 presents descriptive statistics by the child's marital status and gender. The

[25]I further drop the observations which the information indicates that respondents gave birth to their children under age 15. Those observations are likely to be subjected to measurement errors. Also, I experiment on different cutoff ages and the results remain qualitatively robust. Detailed regression analysis is available upon requests.

[26]For example, for 1945-1950 birth cohort, 99.8% of ever-married females and 93.8% of ever-married males got married before the age 35. From 1971 to 1990, the mean age at first marriage was between 26 and 29 for male, and below 26 for female (varied somewhat from year to year). See Chen (2009) and Lin *et al.* (1995) for more details.

average age of the sample is 44 with marriage rate[27] being 94.5 percent being married. Single children are roughly 3.5 years younger than married children, but there is no significant age difference between male and female children by marital status. In general, this population is relatively low-educated with half of individuals only completing six-year primary education or below.[28] However, while males' educational levels do not differ much with respect to their marital status, single females are much more educated than their married counterparts. For example, 33 percent of the former have university degrees or above whereas the corresponding proportion of the latter is merely 1 percent. There are also stark differences in employment status across types of children. As expected, the majority of married males work in full-time positions whereas more than half of the married females are unemployed. Meanwhile, there seems to be no gender disparities in the employment status among single children. In addition, on average children have 5.8 siblings which indicates that parents are likely to have multiple potential care-givers.

The key variable for the analysis is the distance D_{it} between parents' and child i's location of residence at time t. The information provided in the survey distinguishes whether a particular child lives in the same household as their parents ($D_{it} = 0$), in the same neighborhood or next door ($D_{it} = 1$), in the same city ($D_{it} = 2$), in other cities in Taiwan ($D_{it} = 3$), or outside Taiwan ($D_{it} = 5$). The main purpose of empirical study is to examine the living arrangements by children's marital status and gender. The theoretical framework hypothesizes that married children are more likely to be in the higher distance categories than single children. Moreover, there should be no significant gender difference with respect to distance among single children. In contrast, married males would live closer to their parents than married females.

Simple descriptive statistics in Table 1.2 provide some initial insights into the theoretical hypothesis and suggest a systematic difference in residential choices by a child's marital status and gender that confirms predicted patterns. Consider first the distance category (children in the same household with parents): while 56.64 percent of single males and 55.17 percent of single females co-reside with their parents, the corresponding

[27]The high marriage rate is in line with the national trend during the period of study. See data from National Statistics, Republic of China

[28]This is again in line with the national trend. Compulsory education was only extended from six years to nine years in 1968 in Taiwan. The majority of cohort who were not affected by this extension merely completed six-year primary education. See Taiwan Ministry of Education for detailed statistics.

percentage for married males and married females are 25.77 percent and 2.19 percent respectively. The observation that married children live further away from parents is also persistent for the higher distance categories. For example, I find 28 percent of single males and 27.01 percent of single females living in different cities in Taiwan from their parents, compared to 37.7 percent of married males and 53.74 percent of married females. While the gender pattern is clearly documented among married children, the similar difference is not observed among single children.

1.3.1 Baseline Results

The simple tabulation of distance categories by children's type shown above provides preliminary evidences that support theoretical predictions. I then estimate an ordinal logistic regression to examine whether children's locational choices differ systematically by their martial status and gender when controlling for other characteristics. The dependent variable D_{it} identifies five distance categories with lower category representing shorter distance between parents and children. Specifically, the regression estimates the following equation:

$$ln(\frac{P(D_{it} > j)}{P(D_{it} \leq j)}) = \alpha_j + \beta' x, \quad \text{for } j = 0, 1, 2, 3$$

where β and x are $k-$dimensional vectors. The fraction on the left-hand side is the log of the odds that distance D_{it} is greater than j.[29] Here, a negative β_i coefficients indicates that as the value of independent variable x_i increases, the likelihood that children locating in a lower distance category increases.

The coefficients for children's marital status and gender are of particular interests. However, the observed location pattern may be shaped by other individual or household characteristics that have been neglected so far. For example, summary statistics in Table 1.1 indicate that married males on average have slightly higher educational level than single males. This may lead to greater geographical mobility of the former as children leave home region for schools or for more favorable labor markets. Thus I include several demographic characteristics of children and parents in the multivariate analysis to control

[29] I also examine children's locational choices with a multinomial logit model where the effect of independent variable is assumed to be case specific. The conclusion remains qualitatively robust with respect to this specification. The results are available upon request.

for the effects of variables other than children's gender and marital status.

On the child's side, I control for their basic demographic characteristics such as age, age squared, educational level, birth order and employment status in the analysis. Specifically, I use dummy variables to capture whether the child is the first-born[30] and whether the child is currently unemployed. I also include number of brothers and sisters, and number of associated grandchildren. The presence of potential care-givers may increase children's geographical mobility as elder care is regarded as a public good within the family. The number of associated grandchildren would have an opposite effect. Parents may have the incentive to "bribe" the children for the access of grandchildren, as argued in section 1.2.3. Hence I expect children to live closer with their parents as the number of associated grandchildren increases.

As for the parents, the theoretical framework points out two important factors that may greatly influence children' locational choice: parents' need for the care and their wealth. Children are more likely to locate closer if parents have a stronger demand for co-residency or they are wealthy enough to outbid parents-in-law. To capture empirically the first factor, I include dummy variables of whether both parents being alive and age of the oldest parent in the analysis. I expect that a widowed parent requires more attention and care than couple parents. This characteristics has been known to be important to explain intergenerational transfers in goods and services. Similarly, the age of the oldest parent is also a good indicator for children's care-giving responsibilities. Hence, increases in parents' age are likely to result a residential choice in which children locate closer to the parents. As for the second factor, I include parents' monthly income and a dummy variable which equals to 1 if the parents own valuable properties or assets.[31] However, parents' current income may not reflect their level of available resources when children make the residential choices. This is because old-age benefits were extremely limited during the period of study and vary greatly with type of employment.[32] Therefore, I

[30]I also experiment on including more dummy variables for higher birth orders. The main coefficients of interests remain largely unchanged and the coefficients for these additional dummies are not significant. The results are available upon requests.

[31]The survey asked elder respondents whether he/she (and his/her spouse) have houses apart from the one they live in, lands, other fixed assets, shares, savings or other properties.

[32]As Lin (2002) pointed out: "As for old-age income security, government employees (who account for about 6 per cent of Taiwans working force) are entitled to a lump-sum old-age benefit, up to the equivalent of thirty-four months of salary, by the Government Employees Insurance. In addition, they can choose between a lump-sum benefit of up to fifty-three months of salary or a monthly pension equal to 70 per cent of the pre-retirement basic salary, offered by the Retirement Reserve Fund which all

regard ownership of the property as a better measurement for parents' wealth at the time of children's choice.

Table 1.3 reports both the estimated coefficients and the corresponding odds ratios of ordinal logistic regression for the whole sample. The results indicate that for married children, the odds of locating in a higher distance category are 450 percent higher than for single children. Also, the coefficient is significant at 1 percent level after controlling for all the variables mentioned above. This result provides strong evidence to support the first part of prediction 1 that single children on average locate much closer to their parents than married children.

The estimates for other control variables are in line with intuition and with the theoretical predictions of the model. A higher educational level, as expected, is associated with greater geographical mobility, with the effect being most significant among children with university degrees or above. Another factor that is positively correlated with the distance is the existence of potential alternative care-givers. An additional brother increases the odds of a child living in the higher distance category by 15.5 percent. In contrast, the effect of an additional sister is almost negligible. This result echoes the theoretical prediction that males are more likely to locate closer to parents, and thus assume the major responsibility of elder care. I will discuss consequences of siblings compositions on a child's locational choice in a greater detail in section 1.3.3. Variables associated with lower level of mobility include the indicator variable for first born, the number of grandchildren, the parents' need for co-residency and the parents' ownership of the property. In particular, children seem to locate much closer to widowed mother than to widowed father. This result is consistent with those in other studies[33] and the anecdotal evidence that widowed females are perceived to be more vulnerable than widowed males.

Table 1.3 provides some empirical results on children's residential choices for the whole sample. However, these estimates rely on the assumption that the effects of independent variables are identical across various child types. In particular, the same β values are

government employees are required to join based on the Civil Servants Retirement Law. By contrast, Labor Insurance (which covers 33.6 percent of population by 1990) provides only a lump-sum old-age benefit of up to fifty months of salary. Old-age benefits or pension programs for other social strata are virtually nonexistent (with the exception of a farmers' allowance program, which is limited in scale)." This situation remains true until the introduction of National Health Insurance in 1995 and National Pension Program in 2001.

[33]See for example Lee, Parish and Willis (1994)

imposed for single and married children whereas the theoretical framework indicates that these two subsamples significantly differ in their decision process. To examine these possible differential behaviors, I estimate ordinal logistic regressions separately by child's marital status.

Table 1.4 reveals several stark contrasts between single and married children. To start with, the central results confirm the theoretical predictions that married males locate significantly closer to their parents than married females, while no gender pattern ought to be observed among single children. Specifically, for married males, the odds of locating in a higher distance category are 67.6 percent lower than for married females. However, the estimated gender coefficient is not significantly different from zero among single children. Furthermore, single children do not seem to respond to various factors that affect residential choices of married children. For example, both parents' need and ownership of property make the latter locate significantly closer whereas parallel effects are not observed among the former. Similar arguments apply to a child's educational level and existence of potential alternative care-givers. These observations are all consistent with the theoretical argument that single children prefer to locate as close as possible to their parents, independent of parental characteristics.

1.3.2 Matched Couples

I now turn to the underlying mechanisms whereby locational choice varies with a child's marital status and gender. The characterization of equilibrium clearly identifies bargaining power within marriage as a major determinant of couple's location of residence: children with higher bargaining power locate closer to their parents. This section aims to test this statement empirically.

There are two major obstacles for directly examining the effect of a child's bargaining power on a couple's residential choice. To start with, the analysis requires a benchmark of a child's relative bargaining powers within marriage, which unfortunately, is not directly available in the data. However, numerous studies[34] provide evidence that it is strongly correlated with individuals' educational level and employment status in Taiwan. Hence I follow this literature and regard these two measures as good proxies for a child's bar-

[34]See for example Berik *et al.* (2004) and Lee *et al.* (1994).

gaining power.

Furthermore, the survey fails to explicitly link a child with his/her spouse. The main information for the empirical analysis relies on elder respondents specifying their social exchanges with all the potential care-givers, each of whom is identified by their relationship code with respondent. However, in many cases, the provided codes are not detailed enough to match husband and wife at the child level. To address this issue, I use three sources of information to construct the sample of paired couples. First, children and their spouses can be directly identified if relationship codes provide their birth order information. For example, eldest son is the husband of "first" daughter-in-law. This method contributes to roughly two-thirds of successful matchings in the final sample. Second, I take advantage of some special family structures. For example, children can be immediately linked with their spouse if elder respondents only have one daughter or one son. However, summary statistics in Table 1.1 indicates a relative large household size in this sample: the average number of siblings is 5.76. Hence, this source of information only accounts for few observations in the final sample. Third, the remaining sample is constructed based on data for the year 1993, where 574 co-residing children and 1,905 non-coresiding children were directly interviewed for a wide range of information. In particular, children were asked for demographic characteristics of their spouses. I then merge this information with other variables of interests in the main survey. The final sample is consisted of 6,512 couples with non-missing information.

With these data, I estimate an ordinal logistic regression to examine the effect of bargaining power on children's locational choices for this sample. Based on similar rationale as in baseline analysis, I exclude couples with both husband and wife being younger than 35 years old. Each individual's highest educational attainment is classified to five levels: no formal education, primary school, junior high school, high school and university or above, whereas their employment status is categorized as whether the position is full time, part time or individual is currently unemployed. I construct indicator variable for whether a child is more educated than his/her spouse and for whether the child works more hours.

In addition to the control variables in the baseline regression, I also include these indicators of relations of educational level and employment status. The omitted categories

here are couples with the same levels of education or employment status. The theoretical framework predicts that the distance between parents and children would decrease with the child's bargaining power within their own marriage. The regression results reported in Table 1.6 confirm this prediction. For children who are more educated than their spouses, the odds of locating in the higher distance category is 17.6 percent lower than the children who share the same level of education as their spouses. In contrast, this odds is 35.5 percent higher for children who have lower educational level within marriage, with respect to the same reference group. Similar patterns can also be observed regarding a child's employment status:[35] if a child work more than his spouses, the distance between their parents and couples' location of residence decreases and vice versa.

The empirical results here are in line with theoretical predictions. However, I would like to point out some weakness in this analysis. Ideally, the sample in the study of relationships between bargaining power and residential choice would be comparable to the one in the baseline analysis. Unfortunately, this is not the case here. Table 1.5 reports basic summary statistics for the children and their spouses respectively. First, this subsample oversamples co-residing children. The co-residing percentage here is 42.11 percent compared to 13.87 percent co-residing rate for married sample in the baseline analysis. The cumulative percentage also indicates that this population is much more likely to locate in the lower distance categories. Second, this population also oversamples males with the percentage being 67.1 percent. In contrast, the married sample for baseline analysis only includes 49.6 percent of males. Hence, average educational level and employment status are higher in this sample than the benchmark as married females are much less likely to be well-educated or employed in full-time positions than average.

There are mainly two reasons responsible for the oversampling of co-residing children and of males. First, it is likely that elderly respondents disproportionately failed to report basic characteristics of non-coresiding children or their spouses due to less frequent contact. As a consequence, many observations of non-coresiding population have to be dropped in the regression analysis because of missing information. Second, the design of the survey puts more emphasis on married sons than married daughters. In particular,

[35]The effect of independent variables may interact with children's gender. I examine this possibility by running two separate ordinal logistic regressions for males and females. The conclusions remain qualitatively robust. The results are available upon requests.

elder respondents have the option to specify detailed birth order information of a child[36] for daughters-in-law's spouse. In contrast, sons-in-law are coded under a general category lacking this essential information for matching.

1.3.3 Siblings Composition

The analysis so far largely ignores the interactions among siblings. However, important strategic incentives exist[37] within extended households with elderly care being regarded as a public good by siblings. Incorporating public goods assumption into current framework is not entirely straightforward but the equilibrium locational choices can be predicted intuitively. Let us assume that attention from children is perfectly substitutable and parents have no preference for care from a specific child. When there exist multiple potential care-givers, parents may order their bids based on different price tags of their children and exit the auction when the disutility of further bidding outweighs the benefit. Specifically, parents are mostly likely to start their bids on proximity from single children, as they are the "cheapest". If higher level of care is desired, parents can continue to "bribe" the other children, starting with the child with highest bargaining power within marriage. This process lasts until further bidding is no longer optimal.

Now let us consider the potential effects of this process from the child's perspectives. As the number of single siblings or married brothers increases, children may have the incentive to locate further away, as parents are likely to bid the proximity of other siblings and their desired level of attention/care is more easily obtained. In contrast, children with many married sisters may have to locate closer as parents face fierce competition from parents-in-law which raises the price of care. However, the magnitude of this effect might vary with child's gender. We could expect married males' locational choice to be more responsive to the sibling composition than married females because the latter is generally at the bottom of parents' priority bidding list, since they are the most expensive.

Hence, I estimate ordinal logistic regressions for sons and daughters separately with

[36]Daughters-in-law are coded as one of the following six categories: daughters-in-law or sons-in-law, first, second, third, fourth or fifth+ daughters-in-law.

[37]For example, as introduced in the literature review, papers such as Konrad *et al.* (2002) and Rainer *et al.* (2009) have studied intensively on this topic.

dependent variable being the five distance categories. Specifically, I control for the number of a child's married brothers, married sisters and single siblings to examine the effect of sibling composition on their residential choices. The results are reported in Table 1.7. To start with, the estimated coefficients are largely consistent with the intuition: children locate further away as the number of single siblings or married brothers increases whereas the number of married sisters has an opposite effect. The effect is much stronger for sons, with most estimates being significant at 1 percent level. For example, with an additional brother, a married son's odds of locating in a higher distance category is 22.6 percent greater. In contrast, the corresponding estimates for females have the expected signs, but are only significant at 10 percent level. This is to some extent in line with the fact that on average children in this sample have many siblings, and thus parents may be unwilling to bid for married daughters.

One puzzling fact is that the estimated coefficients indicate a smaller effect of single siblings on residential choices than that of married brothers. The former estimates are not significant for males and are only significant at 10% level for females. Also, they are much smaller in magnitude than the estimates on the number of married brothers. One potential explanation for this seeming contradiction is that besides attention and care, parents "bid" for the access to their grandchildren as well. This lowers the priority level of single children who are far less likely to have grandchild. The estimates on number of a child's offspring provide some evidences for this argument. An additional grandchildren reduces the odds of locating in the higher distance category by 4.9 and 11.3 percent for daughters and sons respectively.

In addition, estimates for other control variables also reveal some interesting contrasts between sons and daughters. Prominently, the response with respect to parental characteristics differ greatly by gender. While parents' need for co-residency and wealth seem to have significant effects on sons' locational choices, similar effects are not observed among daughters. For example, parents' ownership of property reduces the odds of a son locating in the higher distance category by 40.9 percent while the corresponding estimate for daughters is not significantly different from zero. Again, this may due to the fact that parents are not willing to "bribe" their married daughters who are normally associated with higher winning prices.

1.3.4 Downward Transfers

Besides implications on location, the theoretical framework also sheds light on the patterns of transfers from parents to children. First, we could expect that single children obtain few downward transfers, as parents have no competitors bidding for children's proximities and thus do not need to "outbid" them. Again, a child's gender would not matter among single children. Second, the competition from parents-in-law combined with relatively lower bargaining power within marriage make married daughters much more expensive to "bribe". Hence on average parents are more likely to transfer to married sons. Third, the probability of transfers would be negatively correlated with the distance between parents and children, as it is served as an incentive mechanism to make children locate closer.

To study the transfer patterns empirically, I estimate logistic regression models with the dependent variables being two alternative measures of downward transfers: whether parents provide any regular time transfers (0/1) and whether parents have ever given major gifts to children (0/1). Note that both variables focus on the extensive margin of transfer behaviors. In the regression, I consider four types of children: married males, married females, single males and single females with the last group being left as the reference population. Also, I control for different distance categories along with other characteristics that might affect a parent's transfer behaviors.

The results are reported in Table 1.8. First, the estimated coefficients indicate that parental transfer vary greatly with children's type. Consistent with theoretical predictions, married males are much more likely to receive downward transfers. For example, their odds of ever receiving a major gift from parents is approximately 8 times higher than for single females. Married females, on the other hand, obtain time transfers more often than their single siblings. However, the estimated coefficient on gender in the regression for a major cash gift is not significantly different from zero. Also, there is no evidence that parents treats single sons differently from single daughters. Second, the results indicate that the probability of a downward transfer is negatively correlated with distance between parents and children. As expected, this inverse relationship is more significant for time transfers than for major gifts. In addition, as the number of grandchildren increases, children are more likely to receive transfers from parents. This supports the

argument that parents may choose to "bribe" for their access to grandchildren.

The empirical results are consistent with theoretical framework. However, using these two variables to study transfer patterns is not entirely satisfactory. First, they may or may not be good indicators of parents' promises at the time of children's residential choices. For one, the first variable measures the probability of current time transfer from parents to children. Only if the agreements between parents and children were involved with future time transfers could it reflect I_i in the theoretical model. In this sense, the second variable seems to be a better measurement of parents' negotiation with children as it captures the entire history of major downward gifts. However, some gifts may not be directly interpreted as parents' "bribes". For example, parents may help children to cover the expenses of medical treatment or support children's education abroad.[38]

Second, these two measures are very likely to suffer from measurement error. Specifically, the construction of the dependent variables follows the procedure below: the surveys asked elderly respondents whether a child received any their help for each listed category, such as household chores. The indicator variable for time transfers or gifts takes the value one if a child was identified as care-receivers for at least one corresponding category. However, one difficulty is that the classifications of categories were not consistent throughout three waves.[39]. To partly account for this problem, I control for year dummies for different waves in the regression analysis. Another difficulty is that the time transfer variable is suffered from a large number of missing values. However, the summary statistics for the children with and without missing information indicate that these two populations

[38]The surveys provide some information about the purpose of these major gifts. For example, 1996 survey asked elderly respondents that whether they have given a large amount of money or property to help children buy a house, go abroad, start a new business, obtain medical treatment, or for other purposes. Unfortunately, response rates of those questions are extremely low prohibiting any further examination.

[39]With respect to time transfers, the corresponding survey questions in the year 1989 were whether respondents provide any help in physical care or in activities of daily livings. In 1993, the questions were whether respondents helped the individual take care of children, do housework or get around. In 1996, the respondents were asked whether they babysat their grandchildren, helped another adult in the family to shop, visit etc, helped someone with daily life activities, helped with keeping an individual accompany or helped with household chores.

The information regarding major gifts was not available in the year 1989. In 1993 survey, children are classified as receiving major gift from parents if his/her parents ever changed ownership of the house, have given stock or business or in the last four years have given a large amount of money or property to children. In the year 1996, the respondents were asked whether the elderly couple had given a large amount of money or property to children in the past year. I also regard individuals who had ever received a ownership transfer of house, stock or business as receiving a major gift from parents. However, any major gifts occurred during 1994 or 1995 were not counted in this measure due to the format of questions in the survey.

do not differ greatly.

1.3.5 Robustness Check

The empirical results are robust with respect to several specifications. First, individuals may not be sufficiently farsighted and rational to make their choices before the problem of care-giving becomes relevant, despite of the greater relocation cost in later years. This lack of farsightedness would no longer be pertinent as parents age and require a high level of care. Therefore, I re-estimate the baseline regression for two subsamples: children whose oldest parent is over age 75[40] and below age 75. The responsibility of elder care is immediate for the former sample whereas for the latter, parents' requirement for extensive attention may still be years ahead. Table 1.9 report the results for these two regressions respectively. The estimated coefficients are extremely similar in magnitude for these two subsamples. I consider this similarity[41] as evidence that individuals indeed act farsightedly and strategically at the time of making residential choices.

Second, children or parents who ever relocate at their later years might differ from rest of population. They may face smaller relocation costs perhaps due to lower requirements in job seniority or network such that they are more capable of timely adjustments in location of residence. Hence, their residential choice at early years may not be that important. To identify this subsample, I examine both parents' and children's residency history[42] and divide the sample to "movers" and "non-movers". The former includes individuals who belong to more than one distance categories during the study period or whose parents move to current place of residence after children turning to age 35. A child is classified to the latter group if neither is true. The summary statistics[43] indicates that "movers" have slightly lower lever of education and employment status than "non-movers". This is consistent with the hypothesis that "movers" might face lower relocation costs.[44] I then re-estimate the baseline regression for "movers" and

[40] I also experiment on other choice of cutoff age and the results largely remain unchanged

[41] I also separately re-estimate the baseline regression by the age of the oldest parent and marital status. The conclusion remains the same.

[42] The data set allows me to reconstruct parents' entire residency history. However, children's residency history can only be inferred from panel structure of the data. Also I exclude all the children who were observed for the first time in the year 1996 as no information regarding their residency history is provided.

[43] The summary statistics is available upon requests.

[44] There are evidences that fathers' decease would increase of probability of mothers' relocation. Other basic characteristics are generally not significantly different in two samples.

"non-movers" respectively and report the regression results in Table 1.10. The general locational patterns are observed in both groups. However, the effects of independent variables seem to be larger for "non-movers". This may due to the fact that "movers" have higher flexibilities in relocation.

1.4 Potential Complications

The empirical analysis presented here is consistent with the theoretical predictions of the model. Here, I discuss some potential complications and possible alternative explanations for the observed location patterns.

Heterogeneous Preferences—Children may differ in their preference regarding parental care. Although the theoretical extension of including heterogeneous preference is straightforward as discussed in section 1.2.3, this generalization imposes difficult empirical questions. Most significantly, information regarding a child's preference is not available in the data. Even if such preferences were directly elicited from children, their answers are likely to be questionable. However, the observed locational patterns could be shaped only if we impose a fairly strong assumption that children's preferences vary systematically with their marital status and gender. Specifically, on average single children would value parental care more than married children whereas married males prefer a higher level of elderly care than married females. Or people who value parental care more are more likely to stay single. Moreover, this asymmetry should be significant enough to generate the observed distinct residential choice by children's type. There is no evidence to support such claims.

Sample Selection—Marital status is a choice variable subjected to various constraints. Especially, as pointed out by Wei and Zhang (2011), in China a male's attractiveness for marriage depends critically on family's saving and their employment options. Therefore, the high co-residing rate among single males may be merely due to their lower capability to establish an independent households than married males. Summary statistics in Table 1.1 indeed reveal a slightly lower educational level and employment status for single males compared to married males. While I cannot entirely rule out this possibility for males, the argument does not seem to be applicable for females; rather the reverse

is true. Single females have much higher level of education than married females and single males. Also, 76.4 percent of single females have full-time positions whereas only 40.9 percent of married females do. The high co-residing rate among the former group contradicts the general perception that education and labor market opportunities tend to make children locate further away. Also, this argument does not explain the similarity between single males and single females with respect to their living arrangements while their basic characteristics differ significantly. Hence, the observed locational patterns could not be attributed to sample selection alone.[45]

Employment—Family networks could be important factors for job opportunities. Single children may locate closer to benefit from better employment prospects while married children have to compromise over spouses' employment opportunities. The excess female distance from parents among married couples could also be explained by this employment argument if husbands' labor market prospects dominate the residential choice of married couples. The key assumption here is that locating closer to parents would benefit a child's employment. This hypothesis may be empirically tested by examining the relationship between a child's distance from parents and their wage. If shorter a distance from parents results in higher wage, then the employment incentive may account for observed locational patterns. However, establishing this causal relationship is extremely difficult as locational decisions are highly endogenous and shorter distance could be driving by higher wages,[46] rather than the reverse. Thus, an exogenous variation affecting children's distance from parents is needed to draw informative conclusions and I will leave this for future research.

1.5 Policy Implications and Conclusion

This paper examines the residential choice of adult children in an intergenerational context. I establish a multi-stage game theoretical model to formalize the intuition that parents and parents-in-law may play strategically to influence a young couple's decision on location. One idea takes center stage: with both parents and parents-in-law valuing

[45]One possible solution is to formally model children's marriage decision in the first place. Then children make the residential choice conditional on their marital status. I will leave this to future work.

[46]For example, in this paper's argument, higher wage may indicate a higher bargaining power within marriage and hence result in shorter distance between parents and children.

care and attention from children, they enter into an auction to bid for a child's proximity in which parents' winning price interacts with the child's bargaining power within marriage. The analysis predicts some structural patterns of children's equilibrium residential choices: single children locate much closer to their parents than married children. Moreover, married females would locate further away than married males whereas this gender difference should not be observed among single children. I then turn to the question that whether the locational patterns predicted by theoretical framework are indeed consistent with the reality. I test my theoretical hypothesis with Taiwan panel data on elder households. The empirical results provide strong evidences supporting the theory.

Importantly, this paper leads to several policy implications. First, the elderly population with only female offsprings may disproportionately bear the consequences of underdeveloped social security system and health care program. This is because services for this particular population may be extremely expensive to obtain when family plays the central role in elderly care. Hence, any advancement in social security net would be especially beneficial for them. Second, despite of recent efforts, pro-male bias in fertility choice remains markedly strong in Asia. This paper points out a potential explanation of son preference: daughters may be perceived to have lower expected future returns due to their lower bargaining powers within marriage. This perception may result in sex-selective abortions or under-investment in daughters' education, health etc. Hence, policies that promote females' intra-household bargaining power may ameliorate the "missing women" problem.

The application of proposed framework is not confined to Taiwan alone. The similar gender differences in adult children's residential choices are not only observed in the countries such as China and Mexico[47] where social security systems are under-developed and family plays the central role in elder care, but also in the states such as Norway and Japan[48] where the provision of public services is proficient. Although the explanatory power of proposed decision process depend on many other factors in different contexts, this paper offers incentives and mechanisms that widely exist.

[47]For example, Sovero (2012) provides evidences that in Mexico, it is males who takes the major responsibilities of elder care. Bian *et al.* (1998) documents similar adult children's locational patterns in Mainland China as the ones found in this paper.

[48]For example, Martin and Tsuya (1991) and Loken *et al.* (2011) document similar evidences for Japan and Norway respectively.

Overall, current theoretical framework and empirical results propose a coherent explanation for observed patterns. However, any further cost effectiveness analysis of policy interventions requires a more precise characterization of decision process. This makes a structural estimation desirable and informative. Unfortunately, lacking essential information of parents-in-law, the current data set is inadequate for conducting further estimations and I leave this topic to future research. Another potential extension is to incorporate a richer structure in the current framework. Specifically, as pointed out by several studies, strategic incentives among siblings are important factors to consider within the extended household. Attention received by parents is now a public goods and siblings may play cooperatively or non-cooperatively to provide care. This extension would better characterize household decision process as there are normally multiple potential donors within households.

1.6 Appendix

1.6.1 PROOF OF LEMMA 1

In Stage 3, the location of the couple l and subsidies from both parents I_H and I_W are regarded as given. The couple's optimization problem is to maximize (5) subject to (2), (3), (4) and to $g_{ij} \geq 0, i, j \in \{H, W\}$. Under the assumption that $w_H > w_W$, first order condition yields the corner solution for elder care:

$$g_{HH} = g_{HW} = 0, G_H = g_{WH}, G_W = g_{WW}$$

Substituting these relationships to the first order conditions and budget constraint proves Lemma 1. □

1.6.2 PROOF OF LEMMA 2

First, budget constraint and first order conditions in stage 3 yield the following equalities:

$$(A1) \quad \frac{1-\beta}{G_H} = \frac{\beta}{c_H} w(1+l)$$

$$(A2) \quad \frac{1-\beta}{G_W} = \frac{\beta}{c_W} w(1+c-l)$$

$$(A3) \quad \frac{\alpha}{c_H} = \frac{(1-\alpha)}{c_W}$$

$$(A4) \quad \frac{\partial c_H}{\partial l} + \frac{\partial c_W}{\partial l} = -wG_H - w(1+l)\frac{\partial G_H}{\partial l} + wG_W - w(1+c-l)\frac{\partial G_W}{\partial l} + \frac{I_W - I_H}{c}$$

Substituting $(A1)-(A4)$ into the first order derivative of the couple's utility U^{couple} w.r.t. l, we can obtain

$$\frac{\partial U^{couple}}{\partial l} = \frac{\alpha\beta}{c_H}(wG_W - wG_H + \frac{I_W - I_H}{c})$$

Therefore, the global maximum of the couple's utility U^{couple} may be achieved at $l = 0, l = c$ or the value $l \in (0, c)$ that solves $G_W - G_H = \frac{I_H - I_W}{cw}$. Before proceeding with the proof, first we note the following property:

Property A1: U^{couple} has a local minimum at $l \; \forall \; l \in (0, c)$ *s.t.* $G_W - G_H = \frac{I_H - I_W}{cw}$.

Proof: According to LEMMA 1, we can rewrite the condition $G_W - G_H = \frac{I_H - I_W}{cw}$ as

$$(A5) \quad (A + I_H)(1-\beta)(\frac{1-\alpha}{1+c-l} - \frac{\alpha}{1+l}) = \frac{I_H - I_W}{c}(1 + l(1-\beta)(\frac{1-\alpha}{1+c-l} - \frac{\alpha}{1+l}))$$

On the other hand,

$$\frac{\partial^2 U^{couple}}{\partial l^2} = -\frac{\alpha\beta}{c_H^2}\frac{\partial c_H}{\partial l}(wG_W - wG_H + \frac{I_W - I_H}{c}) + \frac{\alpha\beta w}{c_H}(\frac{\partial G_W}{\partial l} - \frac{\partial G_H}{\partial l})$$

Since $G_W - G_H = \frac{I_H - I_W}{cw}$, then the sign of $\frac{\partial^2 U^{couple}}{\partial l^2}$ is entirely determined by $\frac{\partial G_W}{\partial l} - \frac{\partial G_H}{\partial l}$.

Note that

$$(A6)\quad \frac{1-\beta}{w}(\frac{\partial G_W}{\partial l}-\frac{\partial G_H}{\partial l}) = \frac{1-\alpha}{(1+c-l)^2}[A+I_H-(1+c)\frac{I_H-I_W}{c}] + \frac{\alpha}{(1+l)^2}[A+I_H+\frac{I_H-I_W}{c}]$$

The proof of the property proceeds now in two steps.

First consider the case where $I_H = I_W$, then

$$\frac{1-\beta}{w}(\frac{\partial G_W}{\partial l}-\frac{\partial G_H}{\partial l}) = (\frac{1-\alpha}{(1+c-l)^2}+\frac{\alpha}{(1+l)^2})[A+I_H] > 0$$

Then consider the case where $I_H \neq I_W$, *i.e.* $\frac{1-\alpha}{1+c-l}-\frac{\alpha}{1+l} \neq 0$.

Substituting $(A5)$ into $(A6)$, we obtain

$$\frac{1-\beta}{w}(\frac{\partial G_W}{\partial l}-\frac{\partial G_H}{\partial l}) = [\frac{1-\alpha}{(1+c-l)^2}+\frac{\alpha}{(1+l)^2}-(1-\beta)(\frac{1-\alpha}{1+c-l}-\frac{\alpha}{1+l})^2] \cdot \frac{I_H-I_W}{c}\frac{1}{(1-\beta)}(\frac{1-\alpha}{1+c-l}-\frac{\alpha}{1+l})^{-1}$$

Note that

$$\begin{aligned} & \frac{1-\alpha}{(1+c-l)^2}+\frac{\alpha}{(1+l)^2}-(1-\beta)(\frac{1-\alpha}{1+c-l}-\frac{\alpha}{1+l})^2 \\ > \quad & \frac{1-\alpha}{(1+c-l)^2}+\frac{\alpha}{(1+l)^2}-(\frac{1-\alpha}{1+c-l}-\frac{\alpha}{1+l})^2 \\ = \quad & \alpha(1-\alpha)(\frac{1}{1+c-l}+\frac{1}{1+l})^2 \quad \geq \quad 0 \end{aligned}$$

Moreover, $\frac{I_H-I_W}{c}\frac{1}{(1-\beta)}(\frac{1-\alpha}{1+c-l}-\frac{\alpha}{1+l})^{-1} > 0$ since $G_W - G_H = \frac{I_H-I_W}{cw}$. Therefore, we obtain $\frac{\partial^2 U^{couple}}{\partial l^2} > 0$ for any l s.t. $\frac{\partial U^{couple}}{\partial l} = 0$. $\square$

Now, we proceed with the proof. According to Property A1, the global maximum of the couple's utility U^{couple} can only be achieved at either $l = 0$ or $l = c$. The couple's payoff under these two scenarios are

$$U^{couple} =$$

$$\begin{cases} \alpha\beta log[(A+I_H)\alpha\beta] + \alpha(1-\beta)log\frac{(A+I_H)\alpha(1-\beta)}{w} \\ +(1-\alpha)\beta log[(A+I_H)(1-\alpha)\beta] + (1-\alpha)(1-\beta)log\frac{(A+I_H)(1-\alpha)(1-\beta)}{w(1+c)} \\ \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad \text{if} \quad l=0 \\ \alpha\beta log[(A+I_W)\alpha\beta] + \alpha(1-\beta)log\frac{(A+I_W)\alpha(1-\beta)}{w(1+c)} \\ +(1-\alpha)\beta log[(A+I_W)(1-\alpha)\beta] + (1-\alpha)(1-\beta)log\frac{(A+I_W)(1-\alpha)(1-\beta)}{w} \\ \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad \text{if} \quad l=c \end{cases}$$

Therefore,

$$U^{couple}|_{l=0} - U^{couple}|_{l=c} = log\frac{A+I_H}{A+I_W} + (2\alpha-1)(1-\beta)log(1+c)$$

Hence the equilibrium location is determined by the comparison between $U^{couple}|_{l=0} - U^{couple}|_{l=c}$ and 0. □

1.6.3 PROOF OF PROPERTY 1

First note that conditional on I_W, P_H's utility is

$$U^{P_H} = \begin{cases} y_H - I_H + u_H(\frac{(A+I_H)\alpha(1-\beta)}{w}) & \text{if} \quad l=0 \\ y_H + u_H(\frac{(A+I_W)\alpha(1-\beta)}{w(1+c)}) & \text{if} \quad l=c \end{cases}$$

Hence, for any $I_W < cA$

$$\begin{aligned} U^{P_H}|_{l=c} - U^{P_H}|_{l=0} &= I_H + u_H(\frac{(A+I_W)\alpha(1-\beta)}{w(1+c)}) - u_H(\frac{(A+I_H)\alpha(1-\beta)}{w}) \\ &\leq I_H + (\frac{(A+I_W)\alpha(1-\beta)}{w(1+c)} - \frac{(A+I_H)\alpha(1-\beta)}{w})u'_H(\frac{(A+I_H)\alpha(1-\beta)}{w}) \\ &\leq I_H + \frac{A+I_W}{1+c} - (A+I_H) \qquad \text{(by assumption)} \\ &< 0 \end{aligned}$$

On the other hand, note that $-I_H + u_H(\frac{(A+I_H)\alpha(1-\beta)}{w})$ with $I_H = \lceil (A+I_W)(1+c)^{(1-2\alpha)(1-\beta)} - A \rceil$ is monotonic decreasing while $u_H(\frac{(A+I_W)\alpha(1-\beta)}{w(1+c)})$ is strictly increasing with respect to I_W. Hence, for I_W sufficiently large, the latter is strictly greater than the former. Com-

bined with the continuity of the utility function, we can conclude that K_2 exists and it is unique. Moreover, $K_2 \geq 0$. $\square$

1.6.4 PROOF OF PROPOSITION 1

The characterization of subgame-perfect equilibrium of the this game hinges critically on the magnitude of B_1, K_1, B_2 and K_2. The proof of the proposition proceeds with the discussions under different assumptions of parameter values.

First consider the situation that $B_1 < K_1$.

(i) Assume here that $\frac{A+B_1}{A+B_2} < (1+c)^{(1-2\alpha)(1-\beta)}$, then the equilibrium location choice[49] is $l = c$. To see this, first note that for any $I_H \leq B_1 < K_1$, P_W has the incentive to offer $I_W = \lceil (A+I_H)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil$ which results $l = c$. Also, P_W is wealthy enough to do so for any bid I_H by the assumption that $\frac{A+B_1}{A+B_2} < (1+c)^{(1-2\alpha)(1-\beta)}$ and B_2 is an integer. On the other hand, any offer I_H such that $\lceil (A+I_H)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil < \lceil (A+B_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil$ is strictly dominated by B_1. Therefore, one possible[50] equilibrium choice of subsidy is $I_H = B_1$ and $I_W = \lceil (A+B_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil$.

(ii) Now assume that $\frac{A+B_1}{A+B_2} = (1+c)^{(1-2\alpha)(1-\beta)}$, then the set of equilibrium location choices can be characterized as $l = p \cdot 0 + (1-p) \cdot c$ with $p \in [0,1]$. In this case, first note that along with the assumption $\frac{A+K_1}{A+K_2} < (1+c)^{(1-2\alpha)(1-\beta)}$, we can derive that $B_2 < K2$. Thus, $P_H(P_W)$ never has the incentive to offer any $I_H(I_W)$ such that $\frac{A+I_H}{A+I_W} < (>)(1+c)^{(1-2\alpha)(1-\beta)}$, and both P_H and P_W would alternatively increase their bids until hitting their corresponding upper bounds, that is, $I_H = B_1, I_W = B_2$.

Then we consider the situation that $B_1 = K_1$.

[49]Note that in some very special cases, *e.g.* $(A+B_1)(1+c)^{(2\alpha-1)(1-\beta)} - A$ is an integer, I still face the necessary discussion of the tie-breaking rules. To ease the complication, I simply view those cases as the limiting situation as the value approaches to the integer and thus I assume the same location choice of the couple. The equilibrium location remains the same if I remove this assumption and choose the tie-breaking rule such that the equilibrium exists. The rest of the proof makes the same implicit assumption.

[50]Note that any I'_H and $I'_W = \lceil (A+I_H)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil$ such that $I'_W = \lceil (A+B_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil$ is also equilibrium choice of subsidy. However, the equilibrium location choice remains the same. In the following proof, I will only present one example for equilibrium choice of I_H and I_W if multiple equilibria of subsidy choices are possible. In all cases, the characterization of equilibrium location choice is unique.

(i) Assume that $\frac{A+B_1}{A+B_2} < (1+c)^{(1-2\alpha)(1-\beta)}$, then the set of equilibrium location choices can be characterized as $l = p \cdot 0 + (1-p) \cdot c$ with $p \in \{0, 1\}$. First, note that any I_H such that $\lceil (A+I_H)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil < \lceil (A+B_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil$ is strictly dominated by B_1. Also by our assumption, we can conclude $\lceil (A+B_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil \leq K_2$. Thus one possible equilibrium subsidy choice is $I_H = B_1$ and $I_W = \lceil (A+B_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil$, and the resulting equilibrium location is $l = c$. Alternatively, $I_H = B_1$ and $I_W = \lfloor (A+B_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rfloor$ are also mutual best responses and thus the resulting equilibrium location is $l = 0$.

(ii) Assume that $\frac{A+B_1}{A+B_2} = (1+c)^{(1-2\alpha)(1-\beta)}$, then the set of equilibrium location choices can be characterized as $l = p \cdot 0 + (1-p) \cdot c$ with $p \in [0, 1]$. By similar argument as in the case with $B_1 < K_1$, we can see that $I_H = B_1$ and $I_W = B_2$ are mutual best responses regardless of the tie-breaking rule.

Next we consider the situation that $B_1 > K_1$.

(i) Assume that $\frac{A+B_1}{A+B_2} < (1+c)^{(1-2\alpha)(1-\beta)}$, then the equilibrium location choice is $l = 0$. Consider the case that $B_2 \leq K_2$. First note that if P_W choose $I_W = B_2$, then couple prefers $l = c$ for sure regardless of the choice of I_H. However, if $I_H > K_1$, B_2 will be strictly dominated by any choice of I_W that results $l = 0$. On the other hand, if $I_H \leq K_1$, then P_W will be strictly[51] better off by choosing $\lceil (A+I_H)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil$. Thus $I_W = B_2$ is never the equilibrium choice for P_W. For any value of I_W such that $I_W < B_2 \leq K_2$, P_H has the incentive to choose $\lceil (A+I_W)(1+c)^{(1-2\alpha)(1-\beta)} - A \rceil$ to make couple choose $l = 0$. Anticipating this, P_W would prefer to push I_H to B_1 to obtain the highest possible utility. Note that since $B_1 > K_1$, P_W has no incentive to further increase I_W such that the couple prefers $l = c$. Thus the equilibrium choice is $I_H = B_1$ and $I_W = \lfloor (A+B_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rfloor$.

Then consider the case that $B_2 > K_2$. First, any I_H such that $I_H < K_1$ is not an equilibrium choice for P_H since then P_W would offer $\lceil (A+I_H)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil < K_2$ to ensure a locational choice $l = c$. However, conditional on this I_W, P_H would be better off by increasing I_H to the extent that $l = 0$. Next for any $I_H > K_1$, P_W

[51] The assumptions that $\frac{A+B_1}{A+B_2} < (1+c)^{(1-2\alpha)(1-\beta)}$ and $B_1 > K_1$ yields that $\lceil (A+I_H)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil < B_2$ for any $I_H \leq K_1$

prefers that the couple to locate at $l = 0$. Moreover, it is optimal for P_W to bid in the way that P_H would offer his highest possible bid, *i.e.* $I_H = B_1$. Note that in this case if $I_W \leq K_2$, then $I_H = B_1$ is also the best response for P_H. However, if $I_W > K_2$, then P_H has the incentive to undercut I_H until the corresponding bid I_W reaches K_2. Hence, the equilibrium choice is: (1) if $\lfloor (A+B_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rfloor > K_2$, then $I_W = K_2$ and $I_H = \lceil (A+K_2)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil > K_1$; (2) if $\lfloor (A+B_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rfloor \leq K_2$, then $I_H = B_1, I_W = \lfloor (A+B_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rfloor$. In both cases, the equilibrium location choice is $l = 0$. Finally for $I_H = K_1$, the best response of P_W is $I_W \leq \lceil (A+K_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil < K_2$. However, if $I_W = \lceil (A+K_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil < K_2$, then $I_H = K_1$ is no longer P_H's best response. Moreover, any $I_W < \lceil (A+K_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil$ will be strictly dominated by $I_W = K_2$. Therefore, no equilibrium exists in this case.

(ii) Assume now that $\frac{A+B_1}{A+B_2} = (1+c)^{(1-2\alpha)(1-\beta)}$, then the equilibrium location choice is $l = 0$. Consider first that $B_2 \leq K_2$, then the conclusion can be drawn by similar arguments as in case (i). Next consider the case that $B_2 > K_2$ and the arguments follow the same logic as case (i) below.

Finally we consider two additional cases regardless whether B_1 is smaller than, equal to or greater than K_1.

(i) Assume that $\frac{A+B_1}{A+B_2} > (1+c)^{(1-2\alpha)(1-\beta)}$ but $\frac{A}{A+B_2} \leq (1+c)^{(1-2\alpha)(1-\beta)}$, then the equilibrium location choice is $l = 0$.

First consider the case that $B_2 < K_2$. Under this condition, P_H would always prefer subsidy choice I_H such that $I_H = \lceil (A+I_W)(1+c)^{(1-2\alpha)(1-\beta)} - A \rceil$. Meanwhile, P_W would be better off by increasing I_W such that $\lceil (A+I_W)(1+c)^{(1-2\alpha)(1-\beta)} - A \rceil = \lceil (A+K_2)(1+c)^{(1-2\alpha)(1-\beta)} - A \rceil$. Thus the resulting location choice is $l = 0$.

Then assume that $B_2 = K_2$. For any $I_W = K_2$, the best response of P_H is $I_H \leq \lceil (A+K_2)(1+c)^{(1-2\alpha)(1-\beta)} - A \rceil$. Since $I_H = \lceil (A+K_2)(1+c)^{(1-2\alpha)(1-\beta)} - A \rceil > K_1$, then in this case K_2 is the best response for P_W as well and the resulting location choice is $l = 0$. Next consider $I_H = \lfloor (A+K_2)(1+c)^{(1-2\alpha)(1-\beta)} - A \rfloor > K_1$. Now P_W has the incentive to undercut and $I_W = K_2$ is no longer the best response. Finally any I_H such that $I_H < \lfloor (A+K_2)(1+c)^{(1-2\alpha)(1-\beta)} - A \rfloor$ is strictly dominated by

$\lceil (A+K_2)(1+c)^{(1-2\alpha)(1-\beta)} - A \rceil$. On the other hand, any I_W such that $\lceil (A+I_W)(1+c)^{(1-2\alpha)(1-\beta)} - A \rceil < \lceil (A+K_2)(1+c)^{(1-2\alpha)(1-\beta)} - A \rceil$ is strictly dominated by K_2. Therefore, the equilibrium location choice is always $l = 0$.

Finally assume that $B_2 > K_2$. For any $I_W > K_2$, P_H has the incentive to choose $\lfloor (A+I_W)(1+c)^{(1-2\alpha)(1-\beta)} - A \rfloor$ to ensure $l = c$. However, the assumption makes such I_H greater than K_1 which leads P_W to undercut. This process would continue until $I_W = K_2$ and $I_H = \lceil (A+K_2)(1+c)^{(1-2\alpha)(1-\beta)} - A \rceil$ which results $l = 0$. By similar arguments as above, any $I_W < K_2$ such that $\lceil (A+I_W)(1+c)^{(1-2\alpha)(1-\beta)} - A \rceil < \lceil (A+K_2)(1+c)^{(1-2\alpha)(1-\beta)} - A \rceil$ is strictly dominated by K_2. In summary, the equilibrium locatio choice of the couple is always $l = 0$.

(ii) Assume that $\frac{A}{A+B_2} > (1+c)^{(1-2\alpha)(1-\beta)}$, then the equilibrium location choice is $l = 0$. Under this assumption, $(A+B_2)(1+c)^{(1-2\alpha)(1-\beta)}$ is so small that even P_H offers nothing, the couple would still locate at $l = 0$ in stage 2. Thus, P_W is indifferent for any bid and $I_H = 0$ is always the best response for P_H, *i.e.* $I_H = 0, I_W \in [0, B_2]$. □

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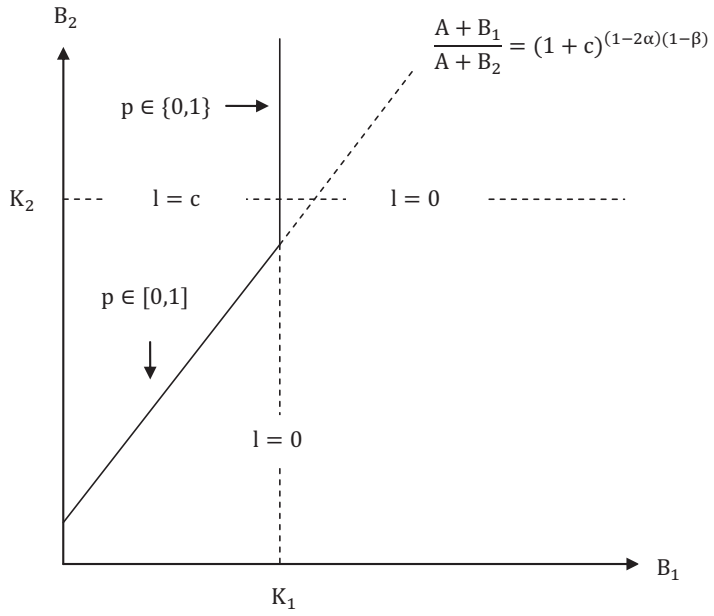

Figure 1.1: Characterization of Subgame-Perfect Equilibrium Location with $\lceil (A+K_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rceil < K_2$

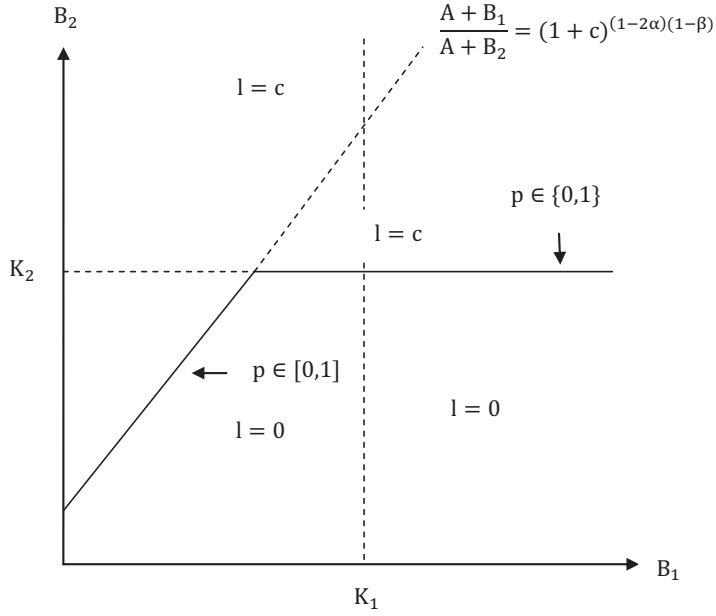

Figure 1.2: Characterization of Subgame-Perfect Equilibrium Location with $\lfloor (A+K_1)(1+c)^{(2\alpha-1)(1-\beta)} - A \rfloor > K_2$

Table 1.1: Summary Statistics by Child Type

	Whole Sample (1)	Single Male (2)	Single Female (3)	Diff (4)	Married Male (5)	Married Female (6)	Diff (7)
Age	43.93	40.32	40.69	-.37	44.13	44.14	-.009
		(.154)	(.195)	(.248)	(.053)	(.054)	(.076)
Below Primary	.083	.070	.059	.011	.036	.131	.-095***
		(.007)	(.009)	(.011)	(.001)	(.003)	(.003)
Primary	.409	.358	.200	.158***	.368	.462	-.094***
		(.014)	(.015)	(.020)	(.004)	(.004)	(.005)
Junior High	.143	.209	.091	.118***	.158	.127	.031***
		(.012)	(.011)	(.016)	(.003)	(.003)	(.004)
High School	.206	.206	.320	-.114***	.232	.176	.056***
		(.011)	(.018)	(.021)	(.003)	(.003)	(.004)
University or Above	.154	.154	.330	-.176***	.202	.010	.102***
		(.010)	(.018)	(.020)	(.003)	(.002)	(.004)
First Born	.267	.211	.180	.030	.270	.272	-.001
		(.011)	(.015)	(.019)	(.003)	(.003)	(.005)
Second Born	.231	.226	.212	.014	.236	.228	.008
		(.012)	(.015)	(.019)	(.003)	(.003)	(.005)
Higher Order	.502	.564	.608	-.044	.494	.501	-.007
		(.014)	(.018)	(.023)	(.004)	(.004)	(.007)
Full Time	.679	.804	.764	.040**	.943	.409	.534***
		(.0112)	(.0161)	(.0196)	(.0018)	(.0038)	(.0042)
Part Time	.022	.017	.016	.001	.013	.032	.019***
		(.0036)	(.0047)	(.0060)	(.0009)	(.0014)	(.0016)
No Job	.294	.175	.217	-.042**	.042	.556	-.513***
		(.0108)	(.0156)	(.0190)	(.0016)	(.0038)	(.0041)
No. of Children	2.43	.18	.22	-.04	2.50	2.62	-.12***
		(.020)	(.029)	(.035)	(.011)	(.011)	(.015)
No. of Siblings	5.76	5.52	5.49	.03	5.69	5.88	-.19***
		(.052)	(.068)	(.086)	(.015)	(.015)	(.021)
Both Parents Alive	.644	.664	.694	-.030	.648	.637	.010**
		(.013)	(.017)	(.022)	(.004)	(.004)	(.005)
Only Mother Alive	.256	.239	.233	.006	.256	.258	-.003
		(.012)	(.016)	(.020)	(.003)	(.003)	(.005)
Only Father Alive	.010	.097	.073	.023*	.096	.104	-.007**
		(.008)	(.010)	(.013)	(.002)	(.002)	(.003)
Father's Age (if alive)	72.3	70.4	71.7	-1.3***	72.4	72.3	.1
		(.194)	(.262)	(.326)	(.060)	(.059)	(.084)
Mother's Age (if alive)	70.3	68.1	69.1	-1.1***	70.4	70.4	.04
		(.198)	(.244)	(.314)	(.058)	(.058)	(.082)
No. of Observations	35,117	1,250	696	-	16,437	16,734	-

Note: The sample includes 50.4% of male and 94.5% of married children. Standard Errors are reported in parentheses. *** Significant at 1% level ** Significant at 5% level * Significant at 10% level.

Table 1.2: Distance between Parents and Children by Child Type

	Whole Sample (1)	Single Male (2)	Single Female (3)	Married Male (4)	Married Female (5)
Distance from Parents (%)					
0: Co-reside	16.21	56.64	55.17	25.77	2.19
1: Next Door/Same Neighborhood	9.61	3.28	2.01	12.77	7.29
2: Same City	25.49	8.96	9.48	20.45	32.34
3: Elsewhere in Taiwan	44.79	28.00	27.01	37.70	53.74
4: Outside Taiwan	3.91	3.12	6.32	3.32	4.45
Distance from Parents (Cumulative Percentage)					
0: Co-reside	16.21	56.64	55.17	25.77	2.19
$\leq$1: Next Door/Same Neighborhood	25.82	59.92	57.18	38.54	9.48
$\leq$2: Same City	51.31	68.88	66.67	58.98	41.81
$\leq$3: Elsewhere in Taiwan	96.09	96.88	93.68	96.68	95.55
$\leq$4: Outside Taiwan	100.00	100.00	100.00	100.00	100.00
Number of Observations	35,117	1,250	696	16,437	16,734

Table 1.3: Ordinal Logistic Regression of Distance Choices (Whole Sample)

Variables	Coefficient (1)	Odds Ratio (2)
Male	-1.039***	0.354***
	(0.0338)	(0.0120)
Married	1.705***	5.503***
	(0.0968)	(0.533)
Age	0.0961***	1.101***
	(0.0210)	(0.0231)
Age Squared	-0.0009***	0.999***
	(0.000223)	(0.0002)
Junior High	0.141***	1.151***
	(0.0405)	(0.0466)
High School	0.125***	1.133***
	(0.0382)	(0.0432)
University or Above	0.730***	2.076***
	(0.0529)	(0.110)
First Born	-0.137***	0.872***
	(0.0369)	(0.0322)
Unemployed	0.069**	1.071**
	(0.0299)	(0.0320)
No. of Children	-0.0915***	0.913***
	(0.00998)	(0.00911)
No. of Brothers	0.144***	1.155***
	(0.0112)	(0.0129)
No. of Sisters	0.0126	1.013
	(0.00976)	(0.00988)
Only Mother Alive	-0.239***	0.788***
	(0.0334)	(0.0263)
Only Father Alive	-0.0790*	0.924*
	(0.0479)	(0.0442)
Age of Oldest Parent	-0.0082***	0.992***
	(0.0029)	(0.0029)
Monthly Income (1000 NT$)	-0.0006	0.999
	(0.0007)	(0.0007)
Property	-0.258***	0.772***
	(0.0954)	(0.0737)
Observations	29,712	29,712

Notes: Standard errors reported in the parentheses are clustered at the individual level. The dependent variable is the distance category of the children's place of residence. Additional independent variables include dummies for year 1989 and 1993. Source: The Survey of Health and Living Status of the Elderly in Taiwan (1989, 1993, 1996).*** Significant at 1% level ** Significant at 5% level * Significant at 10% level.

Table 1.4: Ordinal Logistic Regression of Distance Choices by Child Type

Variables	Single		Married	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio
	(1)	(2)	(3)	(4)
Male	-0.069	0.933	-1.126***	0.324***
	(0.132)	(0.123)	(0.0348)	(0.0113)
Age	0.348**	1.416**	0.092***	1.096***
	(0.137)	(0.194)	(0.0217)	(0.0238)
Age Squared	-0.004**	0.996**	-0.001***	0.999***
	(0.0016)	(0.0016)	(0.0002)	(0.0002)
Junior High	0.232	1.262	0.132***	1.141***
	(0.164)	(0.207)	(0.0419)	(0.0478)
High School	0.009	1.009	0.144***	1.155***
	(0.161)	(0.163)	(0.0398)	(0.0460)
University or Above	0.591***	1.805***	0.771***	2.162***
	(0.177)	(0.320)	(0.0552)	(0.119)
First Born	-0.410**	0.663**	-0.124***	0.883***
	(0.163)	(0.108)	(0.0384)	(0.0339))
Unemployed	-0.217	0.805	0.056*	1.057*
	(0.146)	(0.117)	(0.0307)	(0.0325)
No. of Children	0.284***	1.329***	-0.0995***	0.905***
	(0.0631)	(0.0838)	(0.0104)	(0.0094)
No. of Brothers	-0.018	0.982	0.155***	1.167***
	(0.0487)	(0.0478)	(0.0116)	(0.0135)
No. of Sisters	-0.021	0.979	0.013	1.013
	(0.0393)	(0.0385)	(0.0101)	(0.0102)
Only Mother Alive	-0.122	0.885	-0.249***	0.779***
	(0.138)	(0.122)	(0.0347)	(0.0270)
Only Father Alive	0.403**	1.497**	-0.112**	0.894**
	(0.202)	(0.302)	(0.0492)	(0.0440)
Age of Oldest Parent	-0.007	0.993	-0.008***	0.992***
	(0.0116)	(0.0115)	(0.0030)	(0.0030)
Monthly Income (1000 NT$)	-0.007*	0.993*	-0.0002	1.000
	(0.0038)	(0.0038)	(0.0008)	(0.0008)
Property	-0.081	0.922	-0.298***	0.742***
	(0.314)	(0.290)	(0.0986)	(0.0732)
Observations	1,633	1,633	28,079	28,079

Notes: Standard errors reported in the parentheses are clustered at the individual level. The dependent variable is the distance category of the children's place of residence. Additional independent variables include dummies for year 1989 and 1993. Source: The Survey of Health and Living Status of the Elderly in Taiwan (1989, 1993, 1996).*** Significant at 1% level ** Significant at 5% level * Significant at 10% level.

Table 1.5: Summary Statistics for Matched Couples

Distance between Parents and Children	Percentage (1)	Cumulative Percentage (2)
0: Co-reside	42.11	42.11
1: Next Door/Same Neighborhood	5.87	47.97
2: Same City	20.59	68.57
3: Elsewhere in Taiwan	30.25	98.82
4: Outside Taiwan	1.18	100.00
Individual Characteristics	**Child**	**Spouse**
Male	.671	.329
	(.0058)	(.0058)
Age	43.17	42.69
	(.0897)	(.1033)
Highest Attained Education Level		
Below Primary	.060	.092
	(.0029)	(.0036)
Primary	.380	.340
	(.0060)	(.0059)
Junior High	.157	.167
	(.0045)	(.0046)
High School	.231	.239
	(.0052)	(.0053)
University or Above	.170	.152
	(.0047)	(.0044)
Employment Status		
Full Time	.775	.580
	(.0052)	(.0061)
Part Time	.027	.042
	(.0020)	(.0025)
No job	.197	.295
	(.0049)	(.0057)
Number of Observations	6,512	6,512

Notes: Standard errors are reported in the parentheses. The final sample includes matched couples with non-missing characteristic information. Source: The Survey of Health and Living Status of the Elderly in Taiwan (1989, 1993, 1996).

Table 1.6: Ordinal Logistic Regression of Distance Choice for Matched Couples

Variables	Coefficient (1)	Odds Ratio (2)
Male	-2.124***	0.120***
	(0.104)	(0.0125)
Age	0.097**	1.102**
	(0.0387)	(0.0427)
Age Squared	-0.001**	0.999**
	(0.0004)	(0.0004)
Older than Spouse	-0.048	0.953
	(0.0843)	(0.0803)
Junior High	0.184*	1.202*
	(0.0960)	(0.115)
High School	0.223**	1.250**
	(0.0926)	(0.116)
University or Above	0.829***	2.290***
	(0.116)	(0.265)
More Educated than Spouse	-0.193**	0.824**
	(0.0809)	(0.0666)
Less Educated than Spouse	0.303***	1.355***
	(0.0788)	(0.107)
Full Time	-0.517***	0.596***
	(0.112)	(0.0669)
Part Time	-0.231	0.794
	(0.160)	(0.127)
Work More than Spouse	-0.781***	0.458***
	(0.102)	(0.0469)
Work Less than Spouse	0.303***	1.354***
	(0.0842)	(0.114)
First Born	-0.368***	0.692***
	(0.0860)	(0.0595)
No. of Children	-0.027	0.973
	(0.0289)	(0.0281)
No. of Brothers	0.323***	1.381***
	(0.0234)	(0.0323)
No. of Sisters	0.091***	1.095***
	(0.0210)	(0.0230)
Only Mother Alive	-0.106	0.900
	(0.0767)	(0.0690)
Only Father Alive	-0.041	0.960
	(0.105)	(0.100)
Age of Oldest Parent	-0.006	0.995
	(0.0068)	(0.0067)
Monthly Income (1000 NT$)	-0.003**	0.997**
	(0.0016)	(0.0016)
Property	-0.323*	0.724*
	(0.185)	(0.134)
No. of Observations	6,512	6,512

Notes: Standard errors reported in the parentheses are clustered at the individual level. Additional independent variables include dummies for year 1989 and 1993. Source: The Survey of Health and Living Status of the Elderly in Taiwan (1989, 1993, 1996).*** Significant at 1% level ** Significant at 5% level * Significant at 10% level.

Table 1.7: Ordinal Logistic Regression of Distance Choice for Sibling Composition

	Female		Male	
Variables	Coefficient	Odds Ratio	Coefficient	Odds Ratio
	(1)	(2)	(3)	(4)
Married	3.123***	22.71***	1.126***	3.082***
	(0.120)	(2.724)	(0.0727)	(0.224)
No. of Married Brothers	0.093*	1.097*	0.204***	1.226***
	(0.0509)	(0.0558)	(0.0125)	(0.0153)
No. of Married Sisters	-0.070	0.932	-0.039***	0.962***
	(0.0506)	(0.0472)	(0.0123)	(0.0118)
No. of Single Siblings	0.059*	1.060*	0.053	1.055
	(0.0335)	(0.0355)	(0.0327)	(0.0345)
Age	0.040	1.041	0.123***	1.131***
	(0.0262)	(0.0272)	(0.0253)	(0.0286)
Age Squared	-0.0004	1.000	-0.001***	0.999***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Junior High	0.173***	1.189***	0.115**	1.122**
	(0.0514)	(0.0611)	(0.0449)	(0.0503)
High School	0.161***	1.174***	0.093**	1.097**
	(0.0465)	(0.0546)	(0.0401)	(0.0440)
University or Above	0.686***	1.985***	0.656***	1.928***
	(0.0624)	(0.124)	(0.0442)	(0.0853)
First Born	-0.174***	0.840***	-0.126***	0.881***
	(0.0423)	(0.0355)	(0.0409)	(0.0361)
Unemployed	0.086**	1.089**	-0.148**	0.863**
	(0.0334)	(0.0364)	(0.0741)	(0.0639)
No. of Children	-0.050***	0.951***	-0.109***	0.897***
	(0.0122)	(0.0116)	(0.0120)	(0.0107)
Only Mother Alive	-0.116***	0.890***	-0.366***	0.693***
	(0.0393)	(0.0350)	(0.0364)	(0.0253)
Only Father Alive	-0.026	0.975	-0.122**	0.885**
	(0.0544)	(0.0530)	(0.0530)	(0.0469)
Age of Oldest Parent	-0.004	0.996	-0.014***	0.986***
	(0.0034)	(0.0033)	(0.0031)	(0.0031)
Monthly Income (1000 NT$)	-0.001	0.999	0.0007	1.001
	(0.0009)	(0.0009)	(0.0010)	(0.0010)
Property	0.126	1.134	-0.525***	0.591***
	(0.131)	(0.149)	(0.121)	(0.0713)
No. of Observations	14,657	14,657	15,055	15,055

Notes: Standard errors reported in the parentheses are clustered at the individual level. Additional independent variables include dummies for year 1989 and 1993. The dependent variable is the distance category of the children's place of residence. Source: The Survey of Health and Living Status of the Elderly in Taiwan (1989, 1993, 1996).*** Significant at 1% level ** Significant at 5% level * Significant at 10% level.

Table 1.8: Logistic Regression of Downward Transfers

Variables	Time Transfer		Major Gift	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio
	(1)	(2)	(3)	(4)
Married Male	0.951***	2.587***	2.187***	8.910***
	(0.162)	(0.419)	(0.277)	(2.471)
Married Female	0.765***	2.148***	0.452	1.571
	(0.168)	(0.360)	(0.285)	(0.448)
Single Male	0.276	1.318	0.427	1.533
	(0.194)	(0.256)	(0.328)	(0.503)
Same City	-0.009	0.991	-0.395***	0.674***
	(0.0549)	(0.0544)	(0.0647)	(0.0436)
Elsewhere in Taiwan	-1.097***	0.334***	-0.651***	0.522***
	(0.0551)	(0.0184)	(0.0582)	(0.0303)
Outside Taiwan	-1.196***	0.302***	-0.435***	0.647***
	(0.117)	(0.0354)	(0.128)	(0.0826)
Age	0.020	1.020	0.056	1.058
	(0.0355)	(0.0362)	(0.0371)	(0.0392)
Age Squared	-0.0003	1.000	-0.0006	0.999
	(0.0003)	(0.0003)	(0.0004)	(0.0004)
Junior High	0.176***	1.193***	0.082	1.085
	(0.0645)	(0.0769)	(0.0735)	(0.0797)
High School	0.458***	1.582***	0.281***	1.324***
	(0.0546)	(0.0864)	(0.0630)	(0.0834)
University or Above	0.666***	1.946***	0.309***	1.362***
	(0.0636)	(0.124)	(0.0720)	(0.0980)
First Born	0.035	1.036	-0.004	0.996
	(0.0545)	(0.0564)	(0.0631)	(0.0629)
Unemployed	-0.118**	0.888**	-0.204**	0.816**
	(0.0577)	(0.0513)	(0.0860)	(0.0702)
No. of Children	0.039**	1.040**	0.058***	1.060***
	(0.0158)	(0.0165)	(0.0225)	(0.0238)
No. of Brothers	-0.022	0.978	-0.102***	0.903***
	(0.0152)	(0.0149)	(0.0196)	(0.0177)
No. of Sisters	-0.013	0.987	0.020	1.020
	(0.0139)	(0.0138)	(0.0164)	(0.0167)
Only Mother Alive	-0.010	0.990	0.056	1.058
	(0.0496)	(0.0490)	(0.0562)	(0.0595)
Only Father Alive	-0.253***	0.776***	0.107	1.113
	(0.0727)	(0.0565)	(0.0814)	(0.0906)
Age of Oldest Parent	-0.014***	0.986***	0.013***	1.013***
	(0.0044)	(0.0043)	(0.0047)	(0.0048)
Monthly Income (1000 NT$)	0.006***	1.006***	0.002*	1.002*
	(0.00131)	(0.00132)	(0.00121)	(0.00122)
Property	0.031	1.031	0.735***	2.085***
	(0.137)	(0.142)	(0.140)	(0.292)
No. of Observations	21,668	21,668	19,305	19,305

Notes: Standard errors reported in the parentheses are clustered at the individual level. Additional independent variables include dummies for year 1989 and 1993 with time transfer regression and dummy for year 1993 with major gift regression. Source: The Survey of Health and Living Status of the Elderly in Taiwan (1989, 1993, 1996).*** Significant at 1% level ** Significant at 5% level * Significant at 10% level.

Table 1.9: Ordinal Logistic Regression of Distance Choice by Age of Oldest Parent

Variables	Age of Oldest Parent$\geq$ 75		Age of Oldest Parent$<$ 75	
	Coefficient	Odds Ratio	Coefficients	Odds Ratio
	(1)	(2)	(3)	(4)
Male	-1.047***	0.351***	-1.043***	0.352***
	(0.0530)	(0.0186)	(0.0408)	(0.0144)
Married	1.733***	5.657***	1.692***	5.432***
	(0.179)	(1.013)	(0.108)	(0.586)
Age	0.061*	1.063*	0.150***	1.162***
	(0.0332)	(0.0353)	(0.0461)	(0.0536)
Age Squared	-0.001	0.999	-0.002***	0.998***
	(0.0003)	(0.0003)	(0.0005)	(0.0005)
Junior High	0.153**	1.166**	0.132***	1.141***
	(0.0666)	(0.0777)	(0.0487)	(0.0555)
High	0.185***	1.203***	0.090**	1.094**
	(0.0637)	(0.0767)	(0.0451)	(0.0494)
University or Above	0.863***	2.371***	0.661***	1.936***
	(0.0886)	(0.210)	(0.0621)	(0.120)
First Born	-0.219***	0.803***	-0.109**	0.897**
	(0.0613)	(0.0492)	(0.0446)	(0.0400)
Unemployed	0.101**	1.106**	0.048	1.049
	(0.0472)	(0.0522)	(0.0377)	(0.0395)
No. of Children	-0.087***	0.917***	-0.101***	0.904***
	(0.0139)	(0.0127)	(0.0137)	(0.0124)
No. of Brothers	0.153***	1.165***	0.134***	1.143***
	(0.0163)	(0.0190)	(0.0141)	(0.0161)
No. of Sisters	-0.001	0.999	0.017	1.017
	(0.0147)	(0.0146)	(0.0121)	(0.0124)
Only Mother Alive	-0.245***	0.783***	-0.251***	0.778***
	(0.0511)	(0.0400)	(0.0416)	(0.0324)
Only Father Alive	-0.136**	0.873**	-0.016	0.984
	(0.0634)	(0.0553)	(0.0693)	(0.0682)
Age of Oldest Parent	-0.007	0.993	-0.006	0.994
	(0.0058)	(0.0057)	(0.0049)	(0.0049)
Monthly Income (1000 NT$)	0.002*	1.002*	-0.003***	0.997***
	(0.0015)	(0.0015)	(0.0009)	(0.0009)
Property	-0.368*	0.692*	-0.217**	0.805**
	(0.195)	(0.135)	(0.110)	(0.0884)
No. of Observations	11,100	11,100	18,612	18,612

Notes: Standard errors reported in the parentheses are clustered at the individual level. Additional independent variables include dummies for year 1989 and 1993. Source: The Survey of Health and Living Status of the Elderly in Taiwan (1989, 1993, 1996).*** Significant at 1% level ** Significant at 5% level * Significant at 10% level.

Table 1.10: Ordinal Logistic Regression of Distance Choice by Movers

Variables	Neither Children/Parents Move		Either Children/Parents Move	
	Coefficient	Odds Ratio	Coefficients	Odds Ratio
	(1)	(2)	(3)	(4)
Male	-1.118***	0.327***	-0.981***	0.375***
	(0.0514)	(0.0168)	(0.0486)	(0.0182)
Married	1.826***	6.209***	1.394***	4.032***
	(0.143)	(0.890)	(0.148)	(0.598)
Age	0.136***	1.145***	0.086***	1.089***
	(0.0321)	(0.0368)	(0.0319)	(0.0348)
Age Squared	-0.001***	0.999***	-0.001**	0.999**
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Junior High	0.173***	1.188***	0.207***	1.230***
	(0.0617)	(0.0734)	(0.0613)	(0.0754)
High School	0.102*	1.107*	0.170***	1.185***
	(0.0574)	(0.0635)	(0.0571)	(0.0676)
University or Above	0.931***	2.536***	0.538***	1.712***
	(0.0821)	(0.208)	(0.0763)	(0.131)
First Born	-0.195***	0.822***	-0.069	0.933
	(0.0592)	(0.0487)	(0.0518)	(0.0483)
Unemployed	0.074	1.076	0.037	1.038
	(0.0454)	(0.0489)	(0.0445)	(0.0462)
No. of Children	-0.075***	0.928***	-0.103***	0.902***
	(0.0145)	(0.0134)	(0.0149)	(0.0135)
No. of Brothers	0.179***	1.196***	0.088***	1.092***
	(0.0171)	(0.0205)	(0.0157)	(0.0172)
No. of Sisters	-0.006	0.994	0.030**	1.030**
	(0.0146)	(0.0145)	(0.0143)	(0.0148)
Only Mother Alive	-0.317***	0.728***	-0.134***	0.875***
	(0.0535)	(0.0389)	(0.0454)	(0.0397)
Only Father Alive	-0.152**	0.859**	0.009	1.009
	(0.0693)	(0.0596)	(0.0679)	(0.0685)
Age of Oldest Parent	-0.019***	0.981***	-0.001	0.999
	(0.0046)	(0.0045)	(0.0044)	(0.0044)
Monthly Income	-0.001	0.999	3.02e-06	1.000
	(0.0012)	(0.0012)	(0.0011)	(0.0011)
Property	-0.377***	0.686***	-0.077	0.926
	(0.136)	(0.0931)	(0.164)	(0.152)
No. of Observations	15,070	15,070	11,372	11,372

Notes: Standard errors reported in the parentheses are clustered at the individual level. Additional independent variables include dummies for year 1989 and 1993. Source: The Survey of Health and Living Status of the Elderly in Taiwan (1989, 1993, 1996).*** Significant at 1% level ** Significant at 5% level * Significant at 10% level.

CHAPTER 2

Elderly Parents' and Children's Reports on Intergenerational Transfers: Do They Agree with Each Other?

2.1 Introduction

Parent–child relationships and the degree of contact and support between generations play a substantial role in the well-being of the elderly. Because these relationships involve multiple family members, they can be studied from multiple perspectives—that of elderly parents or that of one or more children. However, all too often researchers tend to rely on reports from one or the other for analysis. Previous studies using paired parent–child dyads show discrepancies in reports of affection, support, and exchanges (Aquilino (1999); Shapiro (2004); Lin (2008); Mandemakers and Dykstra (2008)), reflecting potential conflicting perceptions and interpretations of intergenerational transfers. This difference makes the study of divergent reports essential because it raises questions on the reliability and validity of conclusions based on reports from only one side of the parent–child dyad. Meanwhile, the insight into the phenomenon itself is interesting because perceptual differences would deepen our understanding on the nature of the relationships.

To date, little is known about the degree of discrepancy between parents' and children's reports on measures of intergenerational transfers in newly industrialized countries or regions, with most previous work on this topic concentrating on Europe and the United States alone. This lack of knowledge forms a stark contrast with the necessity of understanding intergenerational relationship in the new context. Here, rapid social and economic change limits some of the traditional family arrangements for caring for the elderly. Meanwhile, smaller numbers of children, higher levels of migration as children

move to professional jobs in new locations, as well as changing attitudes towards privacy, mean that the situation of many elderly will be changing in the years ahead.

Several earlier studies make an attempt to understand the reporting discrepancy in this new context. However, due to the lack of appropriate data sets most of these studies base their inferences on the analysis of comparable samples from unrelated surveys.[1] In contrast, the second wave of Surveys of Health and Living Status of the Elderly in Taiwan (HLSET) Panel enables me to compare directly parents' reports on intergenerational transfers to those of children's. The findings from cross-tabulation reveal high levels of agreement across reports on transfers from parents to children, but slightly less agreement in transfers from children to parents. Moreover, children tend to report a greater level of exchanges of all the examined measures. This consistent over-reporting is somewhat surprising given recent literature's results on the similar topic. Most of them invariantly find that both parents and children over-report providing help and underreport receiving transfers, as self-enhancement theory in psychology suggests.[2] To address this discrepancy from previous studies, I make an attempt to identify potential explanations for the reporting difference in this study. In particular, I share the same argument as Roan *et al.* (1996) who uses the same data set that the observed reporting divergence may be largely due to the difference in question wording in parents' and children's surveys.

Then I study the question that whether substantive results will differ, if reports from different generations are used in analyses. The motivation lies in the fact that in intergenerational studies, the explanation and characterization of intra-household behavior are often achieved through estimating the effect of observable characteristics on self-reported levels of intergenerational transfers. I approach this question by conducting separate regression analysis using parents' and children's distinctive reports of intergenerational transfers as dependent variables. In general, the estimated results are not significantly different from each other.

The remaining of the paper proceeds as follows. Section 2.2 reviews previous literature on reporting discrepancies of intergenerational transfer from distinctive generations.

[1]For example, Hermalin *et al.* (1995) "used two different Taiwanese surveys, one based on a sample of elderly population and the other based on a sample of women of reproductive age, to compare patterns of parent–child coresidence, contact and exchanges of support."

[2]As Fiske (2004) points out, self-enhancement is "a basic psychological tendency to evaluate one's own behavior and skills as better than those of others."

Section 2.3 describes the data and presents the empirical results. Section 2.4 outlines some implications for future data collection efforts of intergenerational studies. Finally, Section 2.5 concludes the paper and discusses several limitations of this study as well as some future challenges of the field.

2.2 Literature Review

Only a handful of previous studies focus on gauging the magnitude of discrepancy in parent–child reports. Early literature generally suggests that parents may be more motivated than adult children to present a picture of strong intergenerational ties (Albrecht *et al.* (1997); Aquilino (1999)). However, much of the difference is examined in the subjective aspects of parent–child relationship. Later studies, in contrast, shift the concentration to the degree to which parents and children agree on measures of intergenerational exchange and support. In general, direct comparison over parent–child reports reveals a relatively high level of agreement on intergenerational transfers.[3] However, the results are far from conclusive. For example, Bond and Harvey (1991) find that elderly parents report greater intergenerational contact than do their children. In contrast, Mandemakers and Dysktra (2008) fail to find such positive bias in parents' report. Other studies (Shapiro (2004); Roan *et al.* (1996); Kim *et al.* (2011)) of different regions suggest that children tend to over-report contact and support relative to their elderly parents.

As yet we know little about why parents and children differ in reporting intergenerational relationships. Earlier work (Giarrusso *et al.* (1995)) generally focuses on psychological explanations that parents are likely to have a greater desire to maintain continuity between generations and bear a greater share in mutual investment. Thus, elderly generations often view the relationship more positively than their children do. In contrast, Shapiro (2004) approaches this question by examining the association between demographic characteristics and degree of discrepancy in parent–child reports. He finds that sex, age, child's marital status, and residential proximity are among the strongest and most consistent variables that influence the correspondence between generations. Other

[3]To my knowledge, Lin (2008) is the only exception here. In analyzing 1997 National Longitudinal Surveys of Mature Women and Young Women, she concludes that mothers and daughters have low levels of agreement on transfers.

work (Lin (2008); Kim *et al.* (2011)) generally follows Shapiro (2004)'s example and applies a multivariate regression model to identify the influential factors on reporting discrepancy.

Even less attention is paid to whether our inferences and conclusions on motivations of transfers would differ, if potentially conflicting reports are used. Rossi and Rossi (1990) is perhaps one of the earliest studies to look into the consequences of using reports from multiple generations in the family.[4] They find that young adults' retrospective accounts of family cohesion, parental affection, and emotional closeness in their adolescence are positively correlated to their current affective closeness with parents. However, this association is insignificant if parents' retrospective data are used. In contrast, based on National Survey of Family and Household data, Aquilino (1999) concludes that the results of predictive models of intergenerational closeness and conflict remain the same regardless of informants. As far as I know, Lin (2008) is the only study that focuses on those intergenerational transfers, in which economists have the greatest interest. Using National Longitudinal Surveys of Mature Women and Young Women, Lin examines the assistance that adult daughters provide to their mothers. She concludes that using mothers' reports identifies different influential factors on transfer decisions than those from using daughters' reports. However, the results are far from conclusive due to the limited sample size in the study and the small magnitude of estimated coefficients (standard errors are not provided by the author).

Lastly, only extremely limited attempts have been made to tackle the difficulty of dealing with conflicting reports from multiple generations. In her study, Lin (2008) tries to separate the covariates' effects on true transfers and biases respectively through multiple steps of a modified multiple indicator and multiple causes (MIMIC) model. Specifically, she conducts a factor analysis using reports from both parties with a latent variable representing true transfers. Then she performs separate regressions to estimate the effect of explanatory variables on predicted level of transfers and corresponding biases. Kim *et*

[4]Lacking available data, many early studies draw their conclusion based on speculation, not on direct comparison of the results based on multiple informants. For example, in a study examining the impact of parental divorce on intergenerational exchange, Amato, Rezac, and Booth (1995) find that the exchanges of support are not adversely affected by parental divorce. This conclusion is consistent with Aquilino (1994) who also relies on parents' reports of intergenerational transfers, but different from other studies using reports from adult children. Amato *et al.* attribute this discrepancy to the differences of the informants in the data.

al. (2011) uses a similar method to estimate the level of reporting discrepancies within parent–child pairs. Despite these efforts, the treatment of the problem still remains relatively preliminary and much more research is needed.

2.3 Empirical Analysis

The empirical analysis in this paper uses the data from the 1993 follow-up wave of the Survey of Health and Living Status of the Elderly in Taiwan (HLSET). The initial survey was conducted in 1989, with a nationally representative sample of 4,049 elderly respondents at age 60 and beyond. Specifically, the sample included individuals living both in private households and government-supported facilities, and the selection was based on stratifications by administrative units, education level, and total fertility rate. In 1993, all the individuals were contacted for follow-up interview and the information was successfully obtained from 3,155 or 78 percent of original respondents. Among the remaining 894 individuals, 65 percent were known to be deceased during the past four years and 35 percent were not successfully located.

The survey was designed to understand appropriate measurement and causal mechanisms about health and well-being of the elderly in Taiwan. Special attention was given to policy-related information of the elder generation, such as their living arrangements, medical care, health behavior, and financial status. In particular, elderly respondents were asked to identify their social networks and social exchanges with all the potential caregivers (including both family member and non-family member). In the 1993 follow-up wave, a subsample ($n = 674$) of elderly respondents were randomly selected for additional adult children's interviews. Within this subsample, face-to-face interviews were attempted with every coresident child and coresident daughter-in-law, while telephone[5] interviews were attempted with every non-coresident child.[6] This new feature enables me to match elder respondents with their adult children and conduct a direct comparison between par-

[5]96 percent of Taiwanese households possess a telephone in 1993. Source: Directorate-General of Budget, Accounting and Statistics (1993).

[6]In total, the selected elderly respondents have 716 coresident children and 2,693 non-coresident children. The response rates for the interviews are 80.2 percent for the former group and 70.8 percent for the latter. The summary statistics indicate that responding children do not differ significantly with non-responding ones in most of the observable characteristics. However, married children are slightly more likely to respond than single children. The results are available upon request.

ents' and child's report on intergenerational transfers within extended households. The final sample for analysis consists of 2,479 parent–child dyads.

Table 2.1 presents descriptive statistics of elderly respondents by sample selection. The mean age of the selected subsample is 72, with 65.6 percent of them being currently married. On average, this population has 4.8 children and 20 percent of individuals have formal or informal employment.[7] The self-reported health status of elderly respondents roughly falls evenly into three broad categories—Excellent, Good, and Fair/Poor—with the corresponding percentages being 38 percent, 25 percent and 21 percent respectively. It is also noticeable that the selected elderly respondents do not differ significantly from non-selected subpopulation in any examined observable characteristics. This provides evidence that the selection process is indeed random.

Table 2.2 provides summary statistics on observable characteristics of adult children[8] who were directly interviewed in the 1993 follow-up interview. 50.4 percent of the sample is male with 83.1 percent being currently married. Also, significant differences in sex composition and marriage status exist between coresident and non-coresident children. For example, the marriage rate is 56.5 percent for the former group and 91 percent for the latter. This observed pattern is consistent with the one documented in Huang (2012). In general, this population has a relatively low level of education with 42.5 percent of individuals completing only six-year primary education or less.[9] There are also stark differences in employment status with respect to children's gender. As expected, the majority of males have full-time positions whereas nearly 40 percent of the females are unemployed. In addition, on average children have 2.3 brothers and 2.4 sisters, which indicates that parents are likely to have multiple potential caregivers.

The key variable for the analysis is the exchange of intergenerational transfers between two generations, as reported from both the parents' and child's perspectives. In the survey, elderly respondents and each child were asked whether they received (or provided) specific types of transfers from (to) any potential benefactor (beneficiary). If the answer

[7]The average national labor participation rate of Taiwan is 41.6 percent for elderly population age 60–64 and 9.8 percent for the population over age 65. See Lee and Yang (2007).

[8]This sample does not include the daughters-in-law who were directly interviewed in the follow-up survey.

[9]This is in line with the national trend. Compulsory education was extended from six years to nine years only in 1968 in Taiwan. The majority of cohorts who were not affected by this extension completed only six-year primary education. See Taiwan Ministry of Education for detailed statistics.

was yes, the respondents were further asked to explicitly identify each of the individual providers (recipients). Those responses enable a match between parents and a child, and hence a direct comparison of their reports on exchanges of various supports.

2.3.1 Summary Statistics

Simple descriptive statistics in Table 2.3 present some initial insights into the level and the discrepancy in parents' and child's reports on intergenerational transfers. First, for each parent–child dyad I examine three measures of financial transfers: whether elderly parents provide (receive) financial assistance to (from) a specific child and whether parents provide a child with large amount of money or transfer the ownership of property as the major gift. Information is available for both coresident and non-coresident children in all three measures. The summary statistics in the table clearly point out frequent financial transfers from adult children to elderly parents: 66.4 percent of parents and 75.5 percent of children report financial assistance from their children/to their parents. In contrast, financial transfers from parents to children are much less frequent. These patterns differ dramatically with numerous studies using U.S. data where a much lower percent of parents report receiving money from a child.[10] The comparison between parents' and child's reports shows that children consistently report higher level of transfers than do their parents in all examined measures. For example, 2.8 percent of elderly respondents report providing financial assistance to a specific child whereas 7 percent of children report receiving them. This is somewhat different from the prevailing arguments that people tend to over-report giving support and under-report receiving them.[11]

Then I examine parents' and child's reports on multiple dimensions of intergenerational time transfers. The examined measures include whether elderly parents provide or receive any help on household chores, whether they receive help on activity of daily livings (ADL)[12] and whether they provide help on taking care of grandchildren. I also construct two indicator variables to represent whether elderly respondents provide/receive at least

[10] See Bianchi *et al.* (2007) for a more detailed review.

[11] See for example Marsden (1990)

[12] The survey also includes information on whether parents provide any help on ADL to a certain child. However, both parents and child report extremely low level of this downward transfer. This may be mainly because adult children's average age is 39.9 and thus a high level of ADL assistance is not required under normal circumstances. Therefore I drop this measure in the analysis.

one type of time transfers from the above list. Due to the survey structure, the only information source of intergenerational time transfers was coresident children rather than the whole sample of adult children.[13] The second part of Table 2.3 reveals moderate levels of time exchanges between generations. For example, 22.3 percent of parents report providing a child with some types of time transfers whereas 18.7 percent of parents report receiving time assistance. Similar to the observed pattern regarding financial transfers, on average adult children report much higher levels of time transfers throughout all the examined types. The discrepancy is extremely large on whether parents receive any help on household chores from a child: 48.3 percent of children report providing the help but only 18.2 percent of parents report receiving help.

Table 2.4 documents the general patterns of correspondence and discordance in parents' and a child's reports on financial transfers. Consistent with Table 2.3, children tend to report higher levels of transfers than do parents. However, a closer look at coresident and non-coresident children separately reveals a distinctive pattern between two groups. For financial assistance from parents to children, 13.8 percent of coresident children report receiving support that parents do not report providing whereas the corresponding number for non-coresident children is 2.8 percent. Similar difference is not observed in the downward transfer of major gifts. The disagreement between parents' reports and children's reports is also apparent on financial assistance from children to parents. For example, 8.7 percent of coresident children report providing financial support to elderly parents who do not report receiving them, and 23.2 percent of parents report receiving support that a coresident child does not report providing. The discordant pattern is somewhat different for non-coresident children where a higher percent of adult children "over-report" providing transfers than do parents "over-report" receiving transfers.

Table 2.5 further presents the correspondence in parents' and children's reports on time transfers. Again, elderly parents and adult children do not always agree with each other. In particular, a significant proportion of adult children report receiving or providing assistance that their parents fail to report. The disagreement is especially large about upward helps on household chores to parents with 36 percent of coresident children "over-reporting" providing this support.

[13] In the survey, only the question whether parents help taking care of grandchildren was asked to both coresident and non-coresident child.

2.3.2 Potential Explanations for Discrepancy

Before proceeding to the regression analysis, I would like to discuss some potential explanations for two generation's reporting discrepancy in this study. First, the distinctive question wording in parents' and children's survey may be the main cause of adult children's consistent over-reporting on intergenerational exchanges.[14] As Roan *et al.* (1996) pointed out, the question asked of children regarding financial assistance in the "past year" differs with that asked of parents regarding "current" financial exchanges. The term "current" is likely to be interpreted as recent ongoing or regular transfers whereas "past year" offers a much longer time horizon.[15] The question wording regarding major gifts from parents to children suffers from a similar problem. The child was asked whether he/she ever received a large amount of money or property from parents whereas the corresponding wording in parents' survey is "in the past 4 years."[16] This difference partly explains adult children's "over-reporting" in financial transfers.

Second, the question wording regarding providers of intergenerational transfers also differs in the parents' and children's surveys. For example, elderly respondents were asked about a child's help on household chores, without any explicit instructions that whether help from a child's spouse should be included or not. Meanwhile, a child was asked whether "you and your husband/wife" provide help on household chores for certain family members and relatives. The inclusion of support provided by spouses may very likely to result in observed "over-reporting" of adult children and we would expect a higher level of parent–child disagreement for a married child than for a single child. The cross tabulation between intergenerational transfers in household chores and a child's marriage status provides evidence to support this claim; 26.9 percent of single children report providing help with household chores that parents do not report receiving whereas

[14]Detailed question wording of intergenerational transfers can be found in the Appendix. Unfortunately the original questionnaire for 1993 follow-up survey is not publicly available. The presented information is based on Roan, Hermalin, and Ofstedal (1996), which conducted a similar study using the same data set.

[15]Roan *et al.* (1996) provide some further evidence by examining the frequency of financial transfers from children to parents. They find that among nonresident children who "over-report" providing financial assistance to parents, 71 percent of them give to parents only on special occasions. However, the evidence is mixed and far from conclusive.

[16]In the 1989 wave of the survey, elderly respondents were asked whether they have ever given a large amount of money or property to anyone. Unfortunately, the question did not ask respondents to identify specific recipients of the gift. Therefore, it is impossible to construct a similar measure as in children's survey that whether elderly parents ever give any major gift to a certain child.

the corresponding percentage is 39.8 for married children. The similar pattern is not observed in help on household chores from parents to children where the question wording is more specific and rules out the help from a child's spouse.[17] The ambiguity in question wording also exists regarding recipients of intergenerational exchange. For example, when elderly parents were asked about financial assistance from a child, they were asked "is there currently someone providing **you** with financial assistance?" Hence, it is not entirely clear whether they should exclude the support provided to their spouse. The expression in the telephone interview with non-coresident children shares the same vagueness. In contrast, coresident children were explicitly instructed to identify specific recipients of their transfers, distinguishing either parent (father or mother) from both parents in their answers. This may partly explain why a coresident child is more likely to fail to report providing financial transfers that parents report receiving than a non-coresident child. The different disagreement patterns by elderly respondents' marital status offer further evidence. Specifically, 30.2 percent of currently married elderly respondents report receiving financial transfers that a coresident child does not report providing whereas only 20.2 percent of widowed respondents do so. Similar distinctive pattern by parents' marital status is not observed among non-coresident children who were asked the similar question as their parents.

Third, intergenerational transfer always has vague boundaries in its definition and thus elderly parents and adult children may not share the same perspective in classifying daily events to mutual transfers. For example, do both parents and children regard paying for food or clothing as financial transfers or not? Or do both of them classify a child's visit to parents' home as intergenerational time transfers? This problem becomes more prominent when a child lives in the same household with his or her parents where certain extent of income pooling or sharing among household members is common and the provision of time assistance is intertwined with the decision of living together.

Finally, previous studies[18] have identified cultural norms of family obligations and social/legal pressures that specify the ways in which family members are expected to behave toward each other as one of the potential phycological explanations for the parent–child

[17]Specifically, 75.9 percent of single children agree with their parents' report while 16.5 percent of them "over-report" this transfers. The corresponding percentages for married children are 75.5 and 19.5 respectively.

[18]See for example Kim *et al.* (2011), Mandemakers *et al.* (2008).

reporting discrepancy. For example, using data from the Netherlands Kinship Panel Study, Mandemakers and Dykstra (2008) shows that parents' family obligations are a strong predictor of discrepancies for both upward and downward exchanges. This factor is particularly likely to be prominent in Taiwan where filial piety has always been essential in the society, and adult children normally assume the major responsibility of taking care of senior members.[19] This filial obligation toward aging parents may result a significant "over-reporting" from adult children.

2.3.3 Observable Characteristics and Transfer Behavior

The simple tabulation in Section 2.3.1 provides us preliminary insights on the parent–child reporting discrepancies regarding intergenerational transfers. However, this is far from enough. One essential aspect of understanding intergenerational relationship is to identify the underlying motivation and mechanisms of intra-household behaviors, and thus to provide policy suggestions by deriving how families would respond to certain political, demographic, and economic changes. These recommendations are often based on empirical studies that examine the relationship between intergenerational transfers and individual observable characteristics. Meanwhile, the reporting discrepancy in the survey is very likely to differ systematically with respect to observable characteristics of interests. For example, ambiguous question wording may lead to a different discrepancy pattern by gender due to males and females' distinctive roles in household production. If this is the case, the analyses based on reporting from a single informant may offer a biased picture between intergenerational transfers and individual characteristics, and thus distort our conclusions for competing hypotheses. Therefore, when reports on mutual support from multiple generations are available, a more important question to ask is whether researchers using reports from elderly parents would identify different effects of covariates on transfers if they were to use reports from adult children.

To answer this question, I estimate separate logistic regressions with dependent variables being reports on intergenerational transfers from different generations respectively

[19]For example, in the 1993 wave of the survey, 88.7 percent of elderly respondents strongly agree and 4 percent agree with the statement that "children have an obligation to take care of old parents." Further, as Chen (2007) pointed out, numerous legislations in Taiwan, such as Civil Law and Senior Citizens' Welfare Act, regulate adult children's "elderly maintenance duty" and draw up punishments in order to prevent elderly desertion.

while keeping the same independent variables. On the right hand side, I include several observable characteristics of both elderly parents and adult children. Specifically, on the children's side, I control for a child's gender, age, educational level (whether a child's highest educational level is university or above, high school, or below high school), marital status (whether a child is currently married), birth order (whether a child is the first-born) and employment status (whether a child currently has full-time employment). I also include the number of a child's siblings, and the number of a child's own children as control variables.[20] As for the parents, I control for their gender, age, marital status (whether their spouses are deceased), self-reported health status (whether elderly respondents report poor health), their monthly income, and an indicator variable that takes the value one if the parents own valuable properties or assets.[21] Moreover, I estimate regressions for coresident children and non-coresident children separately, recognizing the potentially distinct characteristics and motivations between the two groups.

Table 2.6 reports selected regression results on downward financial transfers from parents to children. In general, the estimated coefficients of separate logit regressions based on reports from distinctive generations are not significantly different from each other. For example, we can conclude that fathers are slightly more likely to provide financial assistance to coresident children than mother, regardless of whose reports that we are using.[22] Similarly, if one of elderly parents is deceased, the probability of financial transfers would decrease roughly the same magnitude if children's reports were used instead of elderly parents'. (The results are not shown.)

For numerous questions, economists are particularly interested in estimating the relationship between a child's level of available resources and intergenerational transfers. For example, most empirical studies testing the validity of altruistic models[23] concentrate

[20]Due to the limited sample size, I can not take advantage of all the variation in the data. However, when I experiment on including a finer classification of educational level (below primary school, primary, junior high school, high school, university or above), birth order (first born, second born, and higher order birth), employment status (full-time, part-time, and unemployed), and the number of siblings by gender (the number of brothers and the number of sisters), the estimated coefficients remain largely unchanged. The results are available upon request.

[21]The elderly respondents were asked whether he/she and his/her spouse possess land property, business management rights, shares in company, cash savings, farm or fishery, jewelry, or other valuable properties. The indicator variable takes the value one if the parents own at least one kind of properties from the above list.

[22]The effect is not significant due to large standard errors.

[23]This is one of the most dominating models that characterizes intergenerational relationship where, as Becker (1974, 1991) emphasized in his pioneer work, family members "care" about one another's

on its natural predictions regarding the "sharing of resources within households and the responsiveness of transfers to changes in donors and recipients' income."[24] Consequently, only consistent estimates using reports from distinctive generations should be relied on in distinguishing competing hypotheses. Here, both regressions show that parents are less likely to provide financial assistance to a child with full-time employment, albeit the magnitudes of coefficients under different dependent variables slightly differ. As the employment status is always interpreted as a proxy for the income level, this evidence is consistent with the prediction of the altruistic model of intergenerational relationship. In contrast, both parents and children report that higher level of education and full-time employment would greatly increase the probability of a coresident child receiving large amount of money or property from parents. This may be due to the fact that parents use major gifts to cover for a child's educational expenses or business investment.

Despite general agreement of estimated coefficients, inconsistent results still exist, primarily with respect to elderly parents' monthly income. The regression results using the parents' reports as the dependent variable indicate that a higher level of parents' income would increase the probability of financial assistance and major gifts to a child. This observation is consistent for both coresident and non-coresident children. In contrast, if children's reports are used, the parents' income seems to have no effect on the likelihood of downward transfers. This discrepancy may be partly attributed to the question wording. For example, parents' current monthly income may reflect parents' ability to offer a major gift to a child only within last four years, instead of a much longer time framework.[25] However, it is still worrisome that reports from different generations would lead to opposite conclusions on the effect of an observable characteristic in which researchers are especially interested.

Table 2.7 reports logistic regression results on upward financial transfers from children to parents. Again, the majority of estimated coefficients are not significantly differen-

well-being. The standard model often characterizes parents as the donor and children as the recipients with utility function of the former depending upon the well-being of the latter. As a result, a parent allocates resources in the way that equalizes the marginal utility of her consumption with the (weighted) marginal utility of her child's consumption. This leads to the intuitive prediction that children with fewer of their own resources are likely to receive larger transfers from their parents.

[24]See Bianchi *et al.* (2007).

[25]This is mainly because old-age benefits were extremely limited during the period of study and thus monthly income after retirement may not be a good indicator of elderly parents' true financial status. See Lin (2002) for more details.

t from each other when reports from multiple generations are used. Also, consistent with intuitive findings in previous literature (Davey *et al.* (2004), Eggenbeen and Davey (1998)), both sets of regressions show that needs and resources are the main determinants of probability of intergenerational transfers. Specifically, the results indicate that a child with a higher level of education and better employment outcomes seems to provide more financial assistance, whereas parents with low income level and who do not own any valuable property tend to receive more from their children. Similarly, having a spouse indicates an alternative caregiver other than adult children whereas a widowed or poor-health parent normally has greater needs for assistance. In addition, a child with many offspring of his/her own may have limited resources to provide extra support to elderly parents.

In contrast to the consistent stories told for most observable characteristics, the estimated coefficients with respect to a non-coresident child's gender seem to reveal a distinctive picture under different dependent variables. Using elderly parents' report, sons are much more likely to provide financial assistance than daughters. However, this difference is no longer significant if adult children's reports are used. As discussed in Section 2.3.2, the questions[26] in the parents' survey are likely to be interpreted as asking for regular transfers whereas in the children's survey the response may pick up regular transfers as well as sporadic transfers in special occasions. Therefore, the discrepancies in two sets of regressions may indicate that while non-coresident sons and daughters are equally likely to provide financial assistance at least once, sons are more likely to offer regular financial support to elderly parents. Similar patterns are not observed among coresident children where the transfer frequency is unlikely to differ greatly by gender.

The provision of time assistance is another important dimension of intergenerational transfers. Table 2.8 reports logistic regression results that examine the effects of several covariates on time transfers from parents to children. On the parents' side, although reports based on distinctive perspectives do not lead us to identify vastly different influential covariates, some paired coefficients still differ significantly in their magnitudes. For example, using elderly parents' own reports reveals a larger difference between fathers

[26]Recall that in the survey, adult children were asked whether they provided financial assistance in the past year whereas elderly parents were asked whether they were currently receiving financial transfers from children.

and mothers in their probability of providing help with household chores compared with using adult children's report. This difference may be due to the fact that females are more likely to take major responsibilities in light chores.[27] While elderly parents are fully aware of their own contribution in household tasks, a child without full information may credit the help from mother to both parents. We can also observe inconsistent coefficients with respect to elderly parents' health status. Adult children's reports show that poor health would greatly decrease parents' probability to take care of grandchildren whereas parents' report indicate that their health status has no effect on this support. This discrepancy may be because that parents and children define caring for grandchildren differently: the former may simply regard spending time together as child care. In contrast, the latter may have a much narrower definition where the related activities are more likely to be affected by parents' health status.

On the children's side, the results are largely consistent and they seem to show that parents' preferences and a child's needs both affect the probability of downward time transfers. A coresident child with full-time employment and many children of his/her own has a higher probability to receive time transfers from elderly parents. This is likely to be the group who has binding time constraints and who needs time assistance the most. Among non-coresident children, the only influential covariate on time transfer decision is a child's gender. This may be interpreted as elderly parents on average favoring sons' children more than those of daughters' in a traditional patriarchal/patrilineal society.

Finally, Table 2.9 presents regression results on time transfers from children to parents. Here, we observe significantly different coefficients on a child's gender. On the one hand, parents report a much lower level of help on household chores from sons than daughters. On the other hand, this difference disappears if a child's report is used. As discussed in Section 2.3.2, in the children's survey a coresident child was asked to include help on household chores from his/her spouse, while there is no explicit instruction for elderly parents to do the same. Therefore, this discrepancy may be a natural consequence of females providing most of the help on household chores to parents.

Other main conclusions based on parents' reports and children's reports do not seem to differ greatly. Children respond actively to elderly parents' needs where older, wid-

[27] See for example Casper and Bianchi (2002).

owed parents or parents with poor health are more likely to receive help on household chores and daily activities. The results also indicate that mothers receive more help on household chores than fathers.[28] In contrast, most of a child's observable characteristics do not have a strong effect on their decisions of upward time transfers to parents. For example, a child with full-time employment is equally likely to offer help as an unemployed child. Those results seem to indicate that parents' characteristics and needs play a more important role in upward transfer decisions than a child's available resources.

2.4 Data Collection for Intergenerational Studies

The data requirements for understanding intra-family behaviors are daunting. Inter- and intra-generational support normally involves multiple donors and recipients, and can flow in each direction. Ideally, one must have detailed information on all such exchanges, as well as essential observable characteristics for both parties. Against this background, this section discusses some related lessons obtaining from the Survey of Health and Living Status of the Elderly in Taiwan (HLSET) that might enhance our data collection practice to support intergenerational studies in the future.

2.4.1 Sampling and Coverage

A common theme for data collection effort is the sampling unit. The generic nature of intergenerational studies means that one must reach beyond traditional household-based sampling and include members from multiple generations within extended families. Many datasets manage to extract detailed information for at least two of the coresiding generations; however, omitting information for non-coresident household members may not be satisfactory.[29] Multiple generations living in the same household are likely to require major family decisions involved with intra- and intergenerational compromise and bargaining. In addition, numerous studies[30] provide evidence that coresident and non-coresident adult children differ in multiple dimensions in their observable characteristics

[28]This may be because a child believes that mother needs more help than father.

[29]For example, in a series of interviews with directors or principal investigators of multiple survey studies, the inclusion of non-coresident family members has been identified as a common theme to improve our understanding of family interactions. See Bianchi *et al.* (2007) for more detail.

[30]See for example Huang (2013).

and potential motivation for transfers. There is no doubt that tracing non-coresident family members remains a difficult task. Researchers may combine proxy reporting with tailored survey designs that recognize this difficulty[31] to alleviate attribution bias.

A related question to ask is whether information should be collected for donors and recipients beyond elderly parents and adult children. HLSET makes an extraordinary effort to record mutual exchanges between elderly respondents and all potential care-givers/recipients. This dataset includes governments and non-profit institutions, together with contributors that are normally ignored such as in-laws. These efforts are important mainly in two dimensions. First, marriage relationships and intergenerational ones are always intertwined: elder care decisions are normally reached through compromise and bargaining within marriage, especially in a patrilinear society such as Taiwan. For example, among the daughters-in-law who are interviewed directly in 1993 HLSET supplement survey, 14.3 percent of them report regularly giving their wages to spouse's parents. Moreover, in children's survey, 18.2 percent of coresident children report that they quarrel with their spouse about living with parents or taking care of parents. Thus traditional data collection that omits in-laws' information may provide only a biased picture of intergenerational relationships. Second, there is an increasing recognition of decline in elderly parents' reliance on their children and other family members in regions with traditional family arrangements.[32] However, related public–private tradeoffs and elderly's general well-being during this transition have not been fully studied yet. Consequently, datasets that contain both public and private transfers or the one that can be linked to administrative records of social programs will be extremely valuable in this aspect.

The data quality of surveys with multi-generational designs is always subjected to debate. This debate arises because most such surveys rely heavily on the proxy reporting about the incidence of family interactions and observable characteristics of other family members. Few surveys make an attempt to interview both sides of a dyad. This gap may impose the following difficulties. First, many subjective dimensions are impossible to be reported by a single respondent, such as how different family members view

[31]For example, HLSET offers telephone interviews instead of face-to-face interviews to non-coresident adult children. Also, their question lists are substantially shorter than a coresident child. Hence, HLSET achieves 71 percent response rate among non-coresident children versus 78 percent among coresident children.

[32]See for example Chen (2007).

their relationship between one another and psychological impacts related to intra- and intergenerational relationships. These subjective measures may provide a more direct evaluation of well-being, as well as an indication of transfer motivation and explanations of any reporting discrepancy.[33] Second, proxy reporting is likely to lower data quality, especially about individual observable characteristics. A substantial proportion of elderly respondents from HLSET fails to report basic information for at least one adult child. Expectedly, the data missing problem is more prominently with respect to a non-coresident child. In addition, the cross-comparison between elderly parents' and children's responses reveals certain extent of discrepancy in a child's observable characteristics, which should be reported more precisely by a child him/herself.

Despite its potential, obtaining information from both sides of a dyad is much more costly than relying on proxy reporting. Also, the analysis in this paper fails to justify a clear advantage of collecting transfer information from multiple generations. However, HLSET does not ask parallel questions to elderly parents and adult children, and thus the conclusion is far from conclusive. Therefore, more studies should be done to measure the worth of interviewing both parties for family exchanges before researchers putting it into practice.

2.4.2 Interview Format

Face-to-face interviews have many subtleties, especially when questions are involved with characterizing the relationships of those interviewed with other family members. Several interesting findings emerge from the HLSET survey that indicate the influence of interview formats in data collection efforts.

First, the parent–child reporting discrepancy seem to shrink if other family members are present during the interview. For example, among coresident children who are interviewed alone, 12.34 percent of respondents report instances of financial assistance to elderly generations that parents fail to report. In contrast, the corresponding percentage is 7.32 if any family member is present during the interview. Moreover, the relationship

[33]The simple tabulation reveals that parent–child reporting discrepancy seems to vary with individual's psychological perception of intergenerational relationship. However, due to the serious data missing problem on subjective measures, results are noisy and far from conclusive. The results are available upon request.

between presenters and respondents also seems to influence parent–child reporting discrepancy. For example, when a daughter is present during the interview, it is less likely for elderly parents to report a lower level of time transfer than a child, relative to the situation that a son is present.

Both observations lead to an interesting question on whether the presence of additional family members would improve the data quality with respect to mutual transfers. Similar debates are not new in the survey interview literature. Despite the long-standing discussions in the topic, this remains an open question in social research.[34] Proponents of the approach, such as Lindlof and Taylor (2002), argue that interactions among multiple respondents stimulate memories, ideas and experiences in participants. Morgan and Krueger (1993) also point out that these interactions may provide some insight for the interviewers into the nature of relationships among respondents. Thus, the group interview may be beneficial in investigating complex behaviors and motivations. Both arguments can be easily applied to intergenerational studies, where the presence of direct donors and recipients may not only facilitate the recall, but also reveal intergenerational relationships between respondents.

Despite its potential benefit, the presence of additional family members may also bring issues of observer dependency and social desirability bias. Respondents may tend to answer questions in a manner that will be viewed favorably by other family members, and thus lead to a smaller reporting discrepancy. For example, analysing responses to an administered questionnaire before and after group interviews, Sussman *et al.* (1991) find out that the presence of additional respondents change participants' answers: they have the tendency to conform around particular responses. This shift in response is even more likely to occur in intergenerational study settings where both parties may have a desire to present a positive picture of intergenerational relationship.

2.4.3 Content

Apart from conventional observable characteristics, economists are particularly interested in intra- and intergenerational transfers. However, the generic nature of the survey that requires respondents to report retrospectively may lead to an incomplete picture of the

[34]See Frey *et al.* (1991) for a thorough review of the usage of group interviews in social research.

incidence of transfers. This section is devoted to the potential scope for improvements of survey instruments regarding this problem.

First, when asked of respondents the types of interactions among family members, many studies do not require detailed information of specific donors/receipients. For example, although HLSET is able to identify which adult child exchanges support with elderly parents, interview questions fail to differentiate explicitly a child him/herself from his/her spouse as the real beneficiary/benefactor. Similarly, there is typically no distinction of intergenerational transfers from/to mother, father, or both parents. This distinction has becoming increasingly important as it echoes economists' evolving perspective that households should not be treated as single decision-making units in intra-family behavior.

The second scope of potential improvements centers on whether to provide recall tools such as lists of specific cues in the questionnaire. That is, instead of asking about a general category of transfers such as time or financial assistance, an alternative method is to ask about specific activities of intergenerational exchanges. Reiser *et al.* (1985) provide experimental results that support the usage of sequence of activities in retrieving past experiences. However, Sudman and Bradburn (1973) find that while this technique reduces the omission of activities, there is evidence that respondents tend to report events as having occurred more recently than is actually true, leading to potential overstatement. In addition, they conclude that the technique becomes more beneficial as the span of reference period increases. Therefore, lists of specific activities seem to be most helpful for longer recall periods and for probability of transfers where precise timing of events are less important and omission is the major source of error.

The third observation on the data collection effort for intergenerational studies concerns the reference periods. There is no doubt that there should be explicit emphasis regarding reference periods in the survey. However, the choice of reference periods themselves require the meticulous attention of survey designers. Many studies favor short reference periods, arguing that this may alleviate omission error. For example, Bound *et al.* (2001) study the impact of time on the reporting of consumer expenditures and earnings. They conclude that "the longer the recall period, the greater the expected bias caused by respondent retrieval and reporting error." Similarly, when studying the

welfare entries, Grogger, Haider, and Klerman (2003) use the most recent month of each wave from the Survey of Income and Program Participation to calculate tri-annual entry and exit rates of welfare programs, citing the response accuracy as a reason. However, the choice of short reference periods is also subjected to much criticism. For example, both Eisenhower *et al.* (1991) and Ghose and Bhattacharya (1995) observe substantial overstatement of events for short reference periods. In addition, many authors[35] acknowledge the loss of information in adopting this approach. This information loss may be an especially serious concern in intergenerational studies where family members' perception of obligations and their corresponding behavior may change over time as elderly parents age. Consequently, more research should be conducted to help survey designers to find the right equilibrium regarding reference periods.

Fourth, intergenerational transfers normally have multiple interesting dimensions, prominently their frequency, probability, and amount of exchanges. Many datasets, including HLSET, contain only limited aspects of information. However, the occurrence of regular transfers may infer a completely different motivation and relationship type as opposed to sporadic transfers on special occasions. Or occasional large amount of transfers are by no means inferior to regular small transfers with respect to elder parents' well-being. Therefore, survey questions should be able to reflect these aspects to reveal a more complete picture of intergenerational transfers.

Finally, traditional data collection normally focuses on relatively objective measures, such as incidence of transfers and observable characteristics. However, qualitative interviews for subjective measures, such as respondents' preferences and attitudes, have been proven to provide a valuable supplement to the current effort.[36] Eliciting family members' perception of their obligations towards each other will give more direct information regarding motivations for transfers. Both the cross-sectional difference and its evolvement over time provide an important foundation based on which a formal economic model can be built. In addition, direct measurements of individuals' preference parameters, such as their attitudes towards risk and time preference, may serve as valuable inputs into the model. Therefore, combining qualitative interviewing of subjective measures with

[35]See for example Ham and Shore-Sheppard (2005).

[36]For example, Jarrett and Burton (1999) use independently-conducted qualitative studies to characterize dynamic dimensions of family structure in African American families.

traditional data collection effort may offer considerable promise.

2.5 Conclusion and Discussion

The majority of current intergenerational studies use surveys that rely on one informant's reports on mutual interactions and observable characteristics of all family members. This study, in contrast, uses a unique data set from Taiwan that features in parallel reporting from both generations. I find that a substantial number of parent–child dyads report different levels of intergenerational transfers. Specifically, the reporting discrepancy is larger for upward transfers than for downward transfers where the data suggests a much lower level of support from aging parents to adult children than vice versa. Also, when discrepancies do arise, a child consistently reports a higher level of exchanges between generations than do his/her parents.

The last finding is somewhat different with previous studies (Mandemakers and Dykstra (2008); Shapiro (2004); Rossi and Rossi (1990)) that find both parents and children have a tendency to over-report what they give and underreport what they receive. My explanations of different reports by different family informants and the consistent over-reporting of children focus on distinct wordings in parents' and children's surveys. The questions on financial transfers asked of children are much less restrictive (past year) in the time frame than that asked of parents (currently). Meanwhile, there is an inconsistency about providers/recipients of time transfers between parents' and children's surveys. Despite lacking of direct empirical tests, parent–child different perceptions over exact definitions of transfers along with cultural norm and family obligations may also contribute to the discrepancies in their reports.

The magnitude of discrepancy in reports and its potential explanations are interesting. However, it is how observable characteristics affect intergenerational transfer decision that provides the direct empirical tests for theoretical characterization of intra-household behaviors and motivations. Therefore, I run separate regressions with reports from different parties as dependent variables. I find that most of the estimated coefficients of chosen observable characteristics are not significantly different from each other when using distinctive reports. Moreover, conclusions based on separate regression results are

largely consistent.

Despite the uniqueness of the data set in enabling the examination of multiple respondents under a fairly little-known context, the study has several limitations. First, this wave of the survey selected only one fifth of elderly respondents for additional interviews with their children. As a result, the final number of matched parent–child dyads is relatively small. This leads to noisy regression estimates that make definite conclusions harder to be drawn. Second, non-coresident children were exempt from all but one question on time transfers. Consequently, we lack essential information to fully characterize the relationship between non-coresident children and parents. This also renders a direct comparison between coresident and non-coresident children over time transfers impossible. Third, the discrepancy in parent–child reports may largely due to the inconsistency of question wording in different surveys. This confounding factor makes the identification of other potential explanations for divergent report difficult.

The study of intergenerational relations becomes increasingly important as the population is aging and the better design of old-age supporting systems is imminent. From a modeling perspective, one need to better link inter- and intra-generational processes and mechanisms, which makes the ability to ascertain differences in perspective about interactions and exchanges between family members important. Although studies on reporting discrepancy generally indicate that data from a single informant may not be as skewed as one might think, the level of agreement is regarded as too low to consider entirely ruling out the necessity of surveying multiple members of a family.[37] Nevertheless, beyond the costs of survey effort and expenses, extending interviews to different generations raises issues of sample selection. This does not seem to be a major problem in this study. The response rate in additional surveys is high and children who completed the interviews do not differ with the ones who fail to respond in almost all the examined observable characteristics. However, sample selection problem is prominent in other data sets. For example, Shapiro (2004) find that in National Survey of Families and Households (NSFH) a substantial portion of eligible individuals failed to complete the interview, or "did not provide sufficient information to be included in the analysis." Also, the respondents who completed the survey appear to be healthier and better educated than those who did not.

[37]See Bianchi *et al.* (2007) for a detailed assessment of available data and data needs for studying intra- and intergenerational family relationships and behavior.

Dykstra *et al.* (2004) also find that the response rates for family members who live in the same households as the original respondents are much higher than those who live in separate households. Hence, research on the reasons for additional household members' non-participation and proposals for methods to reduce the selection bias are needed.

Besides more researches on survey design and data collection, we also need to recognize the difficulty involved with dealing with conflicting reports and draw reasonable inference from them. Even when we have all the reports on intergenerational transfers from different perspectives, we still have no actual measures of over-and underreporting, only discrepancies in parent–child dyads. The absence of an objective benchmark renders direct inferences and many established methods to correct measurement errors[38] dubious. A few studies looked into this matter and attempted to simultaneously take advantage of interviews with multiple family members and control for the discrepancy in the reports. However, none of the methods are satisfactory and nearly all those studies lack rigorous tests regarding validation of their methods and the corresponding inferences. Therefore, better theoretical methodologies and empirical verifications are required before we can take advantage of richer information from multiple generations.

Understanding intergenerational relationships requires a recognition of the difficult task of collecting information regarding multiple generations and a willingness to draw on insights from potentially conflicting reports. These difficult yet interesting challenges echo the complex nature of relationships between family members that are consistently transformed by rapid changing social, political, and economic environment.

2.6 Appendix

QUESTION WORKING REGARDING FINANCIAL TRANSFERS

Questions in Parents' Survey:

B17. Is there currently someone providing you with financial assistance?

1. Yes

0. No (Skip to the instructions preceding B18)

[38]See Mittag (2013) for a thorough review.

B17a. Who provides you with financial assistance? Are there any others currently giving you financial assistance? (For each person mentioned, mark a circle in column B17a of the Social Exchange Form).

Questions in Coresident Children's Survey:

B13. In the past year, did you provide money to your parents? [If yes, mark a circle in the support schedule in the intersection between the financial help given column and the father and mother row. If both parents are living, can mark circles for both, unless they are separated or divorced.]

1. Yes [go to B13a]
2. No [go to B14]

Questions in Non-coresident Children's Survey:

16. In the past year, did you give any money to your parents?

0. No [go to 17]
1. Yes [go to 16a]

QUESTION WORDING REGARDING MAJOR GIFT FROM PARENT TO CHILD[39]

Questions in Parents' Survey:

F15. In the last 4 years given a large amount of money/property to child?

F15_A1. Who did you give money/property to?

Questions in Coresident Children's Survey:

B18. Ever received a large amount of money/property from parents?

QUESTION WORDING REGARDING HOUSEHOLD CHORES FROM CHILD TO PARENT

Questions in Parents' Survey:

B15. Is there someone currently helping you to do any of the following: purchasing food and everyday use items, cooking, cleaning, doing the laundry, repairing things, making telephone calls, writing letters, paying bills, taking care of property, or other everyday matters?

0. No (Skip to B16)

1. Yes

B15a. Who helps you? Are there any others who are currently helping you? (For each person mentioned, mark a circle in column B15a of the Social Exchange Form.)

Questions in Coresident Children's Survey:

B8. Below, I'd like to ask you about the situation of mutual help in every day routines and activities between you and your family members and relatives and friends, especially your parents. First, I'd like to ask you whether you and your husband/wife help some of your family members or relatives buy groceries or other common household items, pay

[39]The exact question asked is not publicly available. The information here is based on data codebook.

bills, do accounts, fix things, make phone calls, write letters, transport, or other strenuous household tasks and the like?

1. Yes [go to B8a]
2. No [skip to b8c]

B8a. Which people do you (and your husband/wife) mostly help? [Mark the mentioned persons with a circle in the supplied ADL grid. If the person has not yet been mentioned (in an earlier section), then fill in schedule II, then you should make circles in the IADL grid] [If parents are not included in this answer, then ask question B8b]

B8b. Have you (and your husband/wife) helped your parents do these chores in daily life?

1. Yes
2. No

QUESTION WORDING REGARDING HOUSEHOLD CHORES FROM PARENT TO CHILD

Questions in Parents' Survey:

B12. Do you currently help any of your family members to do any of the following: purchasing food or everyday use items, cooking, cleaning, doing the laundry, repairing things, making telephone calls, writing letters, paying bills, taking care of property or other everyday matters?

0. No (Skip to B13)
1. Yes

B12a. Who do you provide this kind of assistance to? Do you help anyone else to do these thing? [For each person that the respondent helps to do the above errands, place a

circle in column B12a of the Social Exchange Form.]

Questions in Coresident Children's Survey:

B10. Due to health problems, do you need help with going to buy groceries or other commonly used household items, paying bills, doing accounts, fixing things, making phone calls, writing letters, transportation, or other strenuous household tasks and the like?

1. Needs this very much
2. Needs this a little
3. Doesnt need this

B10a. [Regardless of whether needs help] Currently, is anyone helping you with these daily household chores?

1. Yes [go to B10a1]
2. No [go to B11]

B10a1. Primarily, which people help you do these daily chores? [Mark the mentioned people in support schedule with a circle in the received IADL grid]

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Table 2.1: Summary Statistics by Sample Selection - Elderly Respondents

	Whole	Selected Elderly[40]	Nonselected Elderly	Diff
	(1)	(2)	(3)	(4)
Elderly Respondents				
Male	.549	.537	.552	-.015
	(.009)	(.019)	(.010)	(.022)
Age	71.98	71.97	71.99	-.017
	(.109)	(.225)	(.125)	(.258)
Currently Married	.639	.657	.634	.023
	(.009)	(.018)	(.010)	(.021)
Spouse Diseased	.321	.312	.324	-.012
	(.008)	(.018)	(.010)	(.020)
No. of Children	4.79	4.84	4.77	.067
	(.039)	(.080)	(.044)	(.091)
Currently Employed	.200	.197	.201	-.003
	(.007)	(.015)	(.008)	(.017)
SRH: Excellent	.397	.380	.401	-.022
	(.009)	(.019)	(.010)	(.021)
SRH: Good	.327	.347	.322	.025
	(.008)	(.018)	(.009)	(.021)
SRH: Fair/Poor	.217	.208	.219	-.011
	(.007)	(.016)	(.008)	(.018)
No. of Observations	3,155	674	2,481	-

Note: Standard Errors are reported in parentheses. SRH refers to self-reported health status in the survey. 5.9% of the elderly respondents fail to provide information for this measure. Source: Health and Living Status of the Elderly in Taiwan (1993). *** Significant at 1% level ** Significant at 5% level * Significant at 10% level.

Table 2.2: Summary Statistics - Adult Children

	Adult Children	Coresiding Children	Noncoresiding Children
	(1)	(2)	(3)
Male	.504	.812	.419
	(.010)	(.016)	(.011)
Age	39.87	37.09	40.71
	(.221)	(.399)	(.258)
Married	.831	.566	.910
	(.008)	(.021)	(.007)
First Born	.217	.213	.217
	(.008)	(.017)	(.009)
Second Born	.190	.197	.192
	(.008)	(.017)	(.009)
Higher Order	.593	.591	.591
	(.010)	(.021)	(.010)
No. of Grandchildren	2.46	1.74	2.68
	(.029)	(.070)	(.030)
Primary or Below	.425	.280	.468
	(.010)	(.019)	(.011)
Junior High	.161	.216	.145
	(.007)	(.017)	(.008)
High School	.238	.308	.217
	(.009)	(.019)	(.009)
University or Above	.173	.195	.167
	(.008)	(.017)	(.009)
Male & Full-Time	.883	.837	.911
	(.009)	(.017)	(.010)
Male & Part-Time	.043	.056	.036
	(.006)	(.011)	(.007)
Male & Unemployed	.074	.107	.054
	(.008)	(.015)	(.008)
Female & Full-Time	.496	.630	.483
	(.014)	(.047)	(.015)
Female & Part-Time	.090	.056	.146
	(.006)	(.022)	(.011)
Female & Unemployed	.366	.315	.371
	(.014)	(.015)	(.014)
No. of Brothers	2.27	1.70	2.45
	(.029)	(.056)	(.032)
No. of Sisters	2.44	2.25	2.49
	(.031)	(.064)	(.036)
No. of Observations	2,479	574	1,905

Note: Standard Errors are reported in parentheses. The sample includes elderly respondents' coresiding and noncoresiding children.

Table 2.3: Parents' and Children's Report on Intergenerational Transfers

	No. of Dyads	Parents' Report	Child's Report
	(1)	(2)	(3)
Financial Transfers			
Help the Child with Finance	2,476	.028	.070
	-	(.003)	(.005)
Help the Child with Major Gifts	2,470	.020	.078
	-	(.003)	(.005)
Receiving Help with Finance from Child	2,474	.664	.755
	-	(.009)	(.009)
Time Transfers			
Help the Child with any Time Transfers	572	.223	.362
	-	(.017)	(.020)
Help the Child with Child Care	2,378	.032	.060
	-	(.004)	(.005)
Help the Child with Chores	572	.175	.295
	-	(.016)	(.019)
Receiving any Time Transfers from Child	573	.187	.504
	-	(.016)	(.021)
Receiving Help with Chores from Child	573	.182	.483
	-	(.016)	(.021)
Receiving Help with ADL from Child	572	.056	.087
	-	(.010)	(.012)

Note: Standard Errors are reported in parentheses. "Giving" refers to the downward transfer from parents to adult children, whereas "Receiving" refers to the upward transfer from adult children to parents. Source: Health and Living Status of the Elderly in Taiwan (1993).*** Significant at 1% level ** Significant at 5% level * Significant at 10% level.

Table 2.4: Correspondence in Parents' and Children's Report on Financial Transfers

	Finance			Major Gift		
	All	Coresident	Noncoresident	All	Coresident	Noncoresident
	(1)	(2)	(3)	(4)	(5)	(6)
Downward Transfers (%)						
Parent Gives and Child Receives	.017	.059	.003	.009	.014	.007
	(.003)	(.010)	(.001)	(.002)	(.005)	(.002)
Parent does not Give and Child does not Receive	.918	.772	.963	.911	.925	.907
	(.006)	(.018)	(.004)	(.005)	(.011)	(.007)
Parent does not Give and Child Receives	.053	.138	.028	.069	.051	.074
	(.005)	(.014)	(.004)	(.005)	(.009)	(.006)
Parent Gives and Child does not Receive	.011	.031	.006	.011	.010	.011
	(.002)	(.007)	(.002)	(.002)	(.004)	(.002)
No. of Observations	2,476	574	1,902	2,470	573	1,897
Upward Transfers (%)						
Parent Receives and Child Gives	.573	.421	.619	-	-	-
	(.010)	(.021)	(.011)	-	-	-
Parent does not Receive and Child does not Give	.154	.260	.122	-	-	-
	(.007)	(.018)	(.008)	-	-	-
Parent does not Receive and Child Gives	.181	.087	.210	-	-	-
	(.008)	(.012)	(.009)	-	-	-
Parent Receives and Child does not Give	.091	.232	.048	-	-	-
	(.006)	(.018)	(.005)	-	-	-
No. of Observations	2,474	573	1,901	-	-	-

Note: Standard Errors are reported in parentheses. Source: Health and Living Status of the Elderly in Taiwan (1993).

Table 2.5: Correspondence in Parents' and Children's Report on Time Transfers

	Any	Child Care			Chores	ADL
		All	Coresident	Noncoresident		
	(1)	(2)	(3)	(4)	(5)	(6)
Downward Transfers (%)						
Parent Gives and Child Receives	.168	.025	.070	.011	.114	-
	(.016)	(.003)	(.011)	(.002)	(.013)	-
Parent does not Give and Child does not Receive	.582	.933	.845	.962	.643	-
	(.020)	(.005)	(.015)	(.005)	(.020)	-
Parent does not Give and Child Receives	.194	.034	.063	.025	.182	-
	(.017)	(.004)	(.010)	(.004)	(.016)	-
Parent Gives and Child does not Receive	.056	.007	.023	.002	.061	-
	(.010)	(.002)	(.006)	(.002)	(.010)	-
No. of Observations	572	2,378	573	1,805	572	-
Upward Transfers (%)						
Parent Receives and Child Gives	.144	-	-	-	.141	.045
	(.015)	-	-	-	(.015)	(.009)
Parent does not Receive and Child does not Give	.454	-	-	-	.476	.902
	(.021)	-	-	-	(.021)	(.012)
Parent does not Receive and Child Gives	.360	-	-	-	.342	.042
	(.020)	-	-	-	(.020)	(.008)
Parent Receives and Child does not Give	.042	-	-	-	.040	.010
	(.008)	-	-	-	(.008)	(.004)
No. of Observations	573	-	-	-	573	572

Note: Standard Errors are reported in parentheses. Source: Health and Living Status of the Elderly in Taiwan (1993).

Table 2.6: Logit Regression on Financial Transfers from Parents to Children

	Financial Transfers				Major Gift			
	Coresident Child		Non-coresident Child		Coresident Child		Non-coresident Child	
	C's Report	P's Report	C's Report	P's Report	C's Report	P's Report	C's Report	P's Report
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Parents' Characteristics								
Male	0.285	0.529	-0.174	1.015	0.123	1.370	0.244	1.189**
	(0.264)	(0.446)	(0.292)	(0.692)	(0.434)	(1.111)	(0.190)	(0.465)
Income	0.0046	0.0391***	0.00863	0.0646***	0.0166	0.0376*	0.0117	0.0502***
	(0.0093)	(0.0117)	(0.0111)	(0.0176)	(0.0139)	(0.0224)	(0.0073)	(0.0127)
Child's Characteristics								
Male	0.0642	0.582	0.327	0.995	0.172	1.050	0.914***	1.009**
	(0.289)	(0.405)	(0.306)	(0.624)	(0.534)	(0.826)	(0.202)	(0.439)
Married	-0.134	-0.944*	-0.409	-0.175	-0.0884	-0.985	-0.279	1.719**
	(0.329)	(0.509)	(0.414)	(0.793)	(0.560)	(0.986)	(0.288)	(0.698)
University or Above	0.164	-0.117	0.317	1.171*	1.028**	0.843	0.606***	0.311
	(0.293)	(0.417)	(0.346)	(0.607)	(0.428)	(0.694)	(0.213)	(0.438)
Full-time	-0.492*	-1.037***	-0.234	-1.143*	0.876	1.899**	0.407	-0.438
	(0.262)	(0.356)	(0.332)	(0.676)	(0.585)	(0.921)	(0.253)	(0.498)
Mean	.199	.092	.031	.010	.065	.025	.082	.019
Observations	568	568	1,881	1,881	567	567	1,876	1,876
Pseudo R-Squared	.059	.211	.067	.285	.154	.252	.098	.243

Note: Standard Errors are reported in parentheses. The full regression results are available upon request
. The additional controls on parent's characteristics include parent's age, whether the respondent's spouse is deceased, whether he/she self-reports poor health status and whether they own valuable properties. On child's characteristics, the logistic regression also controls for child's age, the number of grandchildren that a child has, an indicator variable taking the value one if a child finishes high school with the omitting category being below high school, whether a child is first born within extended family and the number of siblings a child has. Source: Author's Calculation from Health and Living Status of the Elderly in Taiwan (1993).

Table 2.7: Logit Regression on Financial Transfers from Children to Parents

	Coresident Child		Non-coresident Child	
	C's Report	P's Report	C's Report	P's Report
	(1)	(2)	(3)	(4)
Parents' Characteristics				
Male	-0.150	-0.329	-0.174	-0.134
	(0.207)	(0.234)	(0.135)	(0.112)
Age	-0.0184	-0.0153	-0.0267**	-0.0033
	(0.0197)	(0.0221)	(0.0126)	(0.0109)
Deceased	0.0848	0.208	0.0531	0.0273
	(0.222)	(0.257)	(0.146)	(0.120)
Poor Health	-0.0360	0.162	0.277	0.0373
	(0.227)	(0.259)	(0.169)	(0.133)
Income	-0.0136*	-0.0142*	-0.0155***	-0.0159***
	(0.0077)	(0.0082)	(0.0056)	(0.0047)
Property	0.160	-0.0811	-0.0840	-0.243**
	(0.191)	(0.212)	(0.136)	(0.113)
Child's Characteristics				
Male	-0.370	0.194	0.168	1.121***
	(0.255)	(0.262)	(0.148)	(0.124)
Married	0.269	0.342	0.426**	0.117
	(0.266)	(0.290)	(0.206)	(0.182)
Age	0.0179	0.0327*	0.0094	0.0130**
	(0.0160)	(0.0175)	(0.0062)	(0.0056)
No. of Children	-0.0308	-0.0315	-0.0948*	0.0107
	(0.0916)	(0.105)	(0.0543)	(0.0466)
High School	0.666***	-0.0683	0.145	-0.160
	(0.234)	(0.256)	(0.185)	(0.150)
University or Above	0.368	-0.208	0.730***	0.289*
	(0.245)	(0.267)	(0.220)	(0.163)
First Born	-0.282	-0.0862	-0.005	-0.352**
	(0.254)	(0.284)	(0.166)	(0.137)
Full-time	1.433***	1.679***	0.412***	0.231**
	(0.258)	(0.253)	(0.143)	(0.117)
No. of Siblings	0.0058	0.122**	0.0357	0.0338
	(0.0474)	(0.0549)	(0.0340)	(0.0283)
Mean	.506	.653	.830	.672
Observations	567	567	1,880	1,880
Pseudo R-Squared	.087	.169	.037	.079

Note: Standard Errors are reported in parentheses. Source: Author's Calculation from Health and Living Status of the Elderly in Taiwan (1993).

Table 2.8: Logit Regression on Time Transfers from Parents to Children

	Child Care				Household Chores		Any Time Transfer	
	Coresident Child		Non-coresident Child		Coresident Child		Coresident Child	
	C's Report	P's Report	C's Report	P's Report	C's Report	P's Report	C's Report	P's Report
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Parents' Characteristics								
Male	-1.654***	-1.051***	0.369	0.589	-0.864***	-2.227***	-1.188***	-1.709***
	(0.333)	(0.378)	(0.277)	(0.504)	(0.222)	(0.320)	(0.219)	(0.265)
Poor Health	-1.180***	-0.188	0.127	-0.855	-0.0761	0.0377	-0.255	-0.0362
	(0.446)	(0.436)	(0.313)	(0.775)	(0.243)	(0.307)	(0.241)	(0.277)
Child's Characteristics								
Male	-0.316	-0.636	0.643**	1.554***	0.0428	−0.213	0.157	-0.0592
	(0.393)	(0.541)	(0.299)	(0.572)	(0.266)	(0.327)	(0.263)	(0.301)
No. of Children	0.450***	0.498***	0.159	-0.0111	0.0135	0.0180	0.118	0.0726
	(0.148)	(0.173)	(0.119)	(0.217)	(0.0988)	(0.128)	(0.0971)	(0.114)
University or Above	0.702**	1.052**	0.655*	0.817	0.0943	-0.366	0.164	-0.0126
	(0.358)	(0.416)	(0.343)	(0.571)	(0.255)	(0.353)	(0.249)	(0.299)
Full-time	0.707	1.234**	-0.202	0.107	0.536**	0.658*	0.664**	0.542*
	(0.436)	(0.621)	(0.323)	(0.649)	(0.269)	(0.353)	(0.262)	(0.310)
Mean	.132	.092	.037	.013	.295	.175	.362	.224
Observations	567	567	1,784	1,784	566	566	566	566
Pseudo R-Squared	.184	.221	.064	.215	.045	.166	.078	.114

Note: Standard Errors are reported in parentheses. The full regression results are available upon request. The additional controls on parent's characteristics include parent's age, whether the respondent's spouse is deceased, the respondent's current monthly income and whether he/she owns valuable properties. On child's characteristics, the logistic regression also controls for child's marital status, age, an indicator variable taking the value one if a child finishes high school with the omitting category being below high school, whether a child is the first born within extended family and the number of siblings a child has. Source: Author's Calculation from Health and Living Status of the Elderly in Taiwan (1993).

Table 2.9: Logit Regression on Time Transfers from Children to Parents

	Household Chores		ADL		Any Time Transfer	
	C's Report	P's Report	C's Report	P's Report	C's Report	P's Report
	(1)	(2)	(3)	(4)	(5)	(6)
Parents' Characteristics						
Male	-0.449**	-0.577**	0.230	0.347	-0.341*	-0.612**
	(0.201)	(0.276)	(0.366)	(0.444)	(0.202)	(0.273)
Age	-0.0336*	0.0663***	0.0350	0.0919**	-0.0302	0.0623**
	(0.0192)	(0.0250)	(0.0315)	(0.0374)	(0.0192)	(0.0247)
Deceased	0.238	0.178	0.748**	0.895**	0.216	0.197
	(0.218)	(0.281)	(0.366)	(0.454)	(0.219)	(0.279)
Poor Health	0.140	0.560**	1.118***	0.547	0.302	0.491*
	(0.220)	(0.272)	(0.328)	(0.425)	(0.222)	(0.271)
Child's Characteristics						
Male	-0.132	-1.464***	0.0952	0.456	-0.0703	-1.427***
	(0.244)	(0.289)	(0.479)	(0.669)	(0.244)	(0.285)
University or Above	-0.411*	-0.646*	-0.0200	-0.225	-0.351	-0.680*
	(0.244)	(0.353)	(0.482)	(0.607)	(0.242)	(0.352)
Full-time	0.319	0.111	-0.286	0.223	0.336	-0.0827
	(0.234)	(0.296)	(0.405)	(0.551)	(0.233)	(0.286)
Mean	.483	.183	.088	.057	.504	.189
Observations	567	567	566	566	567	567
Pseudo R-Squared	.051	.094	.116	.127	.053	.095

Note: Standard Errors are reported in parentheses. The full regression results are available upon request. The additional controls on parent's characteristics include parent's current monthly income and whether he/she owns valuable properties. On child's characteristics, the logistic regression also controls for child's marital status, age, the number of grandchildren that a child has, an indicator variable taking the value one if a child finishes high school with the omitting category being below high school, whether a child is first born within extended family and the number of siblings a child has. Source: Author's Calculation from Health and Living Status of the Elderly in Taiwan (1993).

CHAPTER 3

Lump Sum Tax and Sector Choices: Evidence from a Tax Reform in Rural China

3.1 Introduction

Economists have long been argued that lump sum tax is, on efficient grounds, an ideal tax. This is always served as theoretical grounds for advocates of lump sum tax[1] in some developing countries.[2] However, this theoretical claim is never justified empirically, especially in the rural area where it is mostly implemented. Therefore, a central question for policymakers is whether the lump sum tax is truly efficient in the real context. In particular, does it create any distortion on agricultural incentives?

This paper explores this question by examining the labor supply response to an exogenous tax reform in rural China. The reform changes the total amount of lump sum tax payment at the household level and the intensity of the change is mostly determined by the household size and landownership. In particular, the reform was initially implemented in one province before it extended to other provinces. This makes it possible to use a difference-in-difference strategy to identify the causal effect of a change in lump sum tax on labor supply outcomes. Specifically, I mainly compare sector-specific participation rate for households before and after the reform, between treatment province and control provinces. If the lump sum tax truly has no distortion on marginal effect of labor, the reform should have no effect on sector-specific participation rate. However, contrary to this prediction, I observe a shift from agricultural sector to nonagricultural sector in the

[1]See for example, Newbery (1987): ''The obvious empirical question to ask is how desirable a crude land tax would be from an equity viewpoint (because its efficiency is not in doubt)".

[2]For example, land tax is an important source of rural tax revenue in China before 2005; South Africa initiated a agricultural land tax since 2004 (see Olubode-Awosola); In Zimbabwe, government coalition partners the Movement for Democratic Change has land value taxation as its policy. The governments of Thailand and Hungary also have shown interests with the policy.

data: the proportion of individuals who only work in agricultural sector decreases by 6.5 percentage points while the corresponding statistics at household level is 8 percentage points.

To explain this paradox, I show that lying behind above theoretical argument is the assumption that households have sufficient access to market or nonmarket institutions to fully insure the risk in agricultural production, independent of risk aversion. However, this is an extraordinary assumption for most developing countries.[3] When account is taken of the uncertainty in agricultural income and imperfections in those institutions, increasing lump sum tax increases the marginal risk premium in agricultural sector under decreasing absolute risk aversion (DARA) assumption, and thus implicitly lowers the marginal product of labor in farm production. This creates the incentive to shift away from agricultural sector.

I test this hypothesis by examining heterogeneous treatment effects in several aspects. First, theory predicts that treatment effect should be larger for households whose agricultural income is more uncertain. Hence, I divide the population according to their likelihood of suffering from natural disasters. I find that empirical results are somewhat consistent with theory predictions. Then, I examine the participation rate of nonagricultural self-employment and wage earning activities. The reform also results a shift away from self-employment, which is consistent with the perception that self-employment is riskier. Finally, I compare the treatment effect on savings. If the households are indeed more risk averse because of the increasing lump sum tax, savings should increase as well. There are some suggestive evidences in the data that this is the case.

The idea that lump sum tax is not most efficient when risk is taken into account is not entirely new. Eaton and Rosen (1980) analyze the structure of an optimal linear income tax when workers are uncertain about their wages at the time they choose their labor supplies. They prove that given this uncertainty, lump sum tax is not necessarily efficient. Hoff (1991) uses the similar idea to study land tax. He demonstrates that a move from a pure land tax to a mix of land and low output taxes will reduce preexisting distortions in both consumption and production arising from the imperfection in risk markets. On the other hand, there is another strand of literatures studying the relationship between

[3]See for example, Udry (1990) and Townsend (1994).

occupation/sector choice and wage-risk premium. Arnould and Nichols (1983) use the insight that the market price of a unit of risk is the wage premium an individual would be willing to forgo to engage in an occupation with a lower probability of death or severe injury to estimate the wage-risk premium. Garcia-Penalosa and Caroli (2002) propose a model in which, as incomes grow, works become less risk-averse and move from fixed-wage contracts to variable pay.[4] Also, most papers in above list only propose a theoretical model without providing any empirical evidences. I believe this paper partially fills this gap.

Furthermore, while there is a large amount of empirical literatures studying tax system in developed countries,[5] tax system in developing countries remain largely untouched.[6] Especially, rural area is seldom addressed. This paper is among the very few that focus on rural tax system in China. However, previous studies in this topic either use the aggregate data[7] due to the limited access of the micro-level data or fail to establish a causal relationship.[8] In contrast, I use a micro-level dataset in this paper with detailed households income and expenditure, and particularly category-specific tax payments. Also, two waves of the surveys were conducted before and after the pilot reform respectively, which makes it possible to establish the causal relationship between our interested outcomes and modification of tax regime. In particular, this paper conducts an empirical analysis on the labor supply response to a change of lump sum tax, which has, as far as I know, never been studied before.

In addition, as supplement results, this paper provides some evidences that decreasing absolute risk aversion (DARA) assumption is likely to be satisfied in this context. Also, it suggests that rural households do not have sufficient access to market or nonmarket institutions to fully exchange the risk on farm production. The paper is organized as follows.

[4]Other similar studies include Jacobs, Hartog and Vijverberg (2006), Menezes and Wong (2005). However, there is no paper attempting to combine two perspectives together.

[5]For example, Eissa and Liebman (1996), Meyer and Rosenbaum(2001) studied the effect of Earned Income Tax Credit by comparing labor force participation and relative hours worked between single women with and without children.

[6]Studies of tax system in developing countries include Emrana and Stiglitzc (2005), Auriola and Warlters (2005), Gordon and Li (2009), and Gordon (2010).

[7]For example, Lin, Tao, Liu and Zhang (2002) use provincial data to conduct an accounting exercise regarding both rural and urban tax burden. However, the credibility and preciseness of official aggregate data is questionable.

[8]For example, Tao, Liu and Shan (2004) apply a nice household level panel data from Ministry of Agricultural and a self-conducted survey to study rural tax burden in China. Unfortunately, the paper only establishes the correlation between rural tax burden and several institutional features.

Section 3.2 introduces the institutional background and dataset. Section 3.3 presents basic estimation of treatment effects on total tax payment and labor supply outcomes. Then I describe the theoretical framework in section 3.4. Section 3.5 reports heterogeneous treatment effects along various dimensions and section 3.6 discusses robustness issues. Finally, section 3.7 concludes.

3.2 Institutional Background and Data

3.2.1 Rural Taxation in China

Total tax burden for rural households in China consists of three components: agricultural tax, nonagricultural tax and per capita lump sum tax (fee). While nonagricultural tax is a standard proportional tax levied on the income from household's secondary and tertiary activities, agricultural tax, on contrary, is a form of land tax indexed by the expected output. Specifically, it is calculated by multiplying agricultural tax rate, land leased from government and (unit) expected output, where the last component is estimated based on output of pre-specified period. Mathematically, let T, A, N, L denote the total amount of tax payment, agricultural tax, nonagricultural tax and lump sum tax on household level respectively. Then for a household with land area l, number of individuals n, (per unit land) expected output y^A, nonagricultural income y^N and per capita lump sum tax payment F, the total tax payment is

$$T = A + N + L = \tau^A l y^A + \tau^N y^N + nF$$

where τ^A and τ^B are agricultural and nonagricultural tax rates respectively. One thing to note is that taxable land area is determined the moment households sign the contract with the government. It remains unchanged even the actual cultivated land area alters (Pan (2004), Don (2003)). Similarly, household size for the calculation refers to the number of individuals that appears in the household registration book. Therefore, temporary migration to other regions would not exempt corresponding household member for per capita lump sum fee.

One important characteristic distinguishes agricultural/nonagricultural tax from per

capita lump sum fee: the former is levied by central government while the latter are mostly informal charges imposed by local government. This difference has to be understood under the context of the fiscal arrangements between local and central government. Taxation entails budgetary control and approval, greater transparency and more rigorous monitor from higher levels. Hence for central government, it is a more effective tool to tighten the fiscal discipline of Chinese bureaucracy. On the other hand, "for local government, collection of fees C mostly extra-budgetary in nature C implies more secured entitlement, freedom in application, flexibility in appropriation and, most importantly, relative immunity from the watchful eyes of higher levels". (Yep, 2004). Therefore, in the face of introduction of tax-assignment scheme by central government in the 1990s, local government reacted in the way of "laxity in gathering taxes and exuberance in collecting fees and surcharges" (Yep, 2004). For example, tax revenue as percentage of GDP dropped from 22.8 in 1985 to 10.1 in 1996, while the corresponding statistics for fee collection increases from 2.6 in 1985 to 8.8 in 1996.[9] Consequently, a cycle was created: local government tried to keep budget balance by expanding fee collection if tax revenues are insufficient. The greater local autonomy resulted from excessive informal charges further enhanced the incentive for fee collection. This problem was especially prominent in rural area where supervised authorities were extremely malfunctioned.

3.2.2 Tax Reform

The introduction of Tax-for-Fee reform mainly reflected central governments two rising concerns regarding unbridled collection of local fees: (1) its declining capacity for fiscal regulation; (2) excessive peasants burden and potential political unrest associated with it.[10] The idea of tax-for-fee first emerged as a possible policy option to tackle the problem of chaotic fund-raising in the countryside in a joint document issued by several ministries and commissions in 1995. Around this period, few prefectures in several provinces voluntarily initiated some pilot reforms. By 1999, pilot projects were introduced in more than 50 counties and prefectures in seven provinces, including Anhui, Hunan, Inner Mongolia, Sichuan and Hebei. In 2000, the state Council decided to designate Anhui province as a

[9]Source: Li, Shangcheng et al. (eds.). Tax-for-Fee (Beijing: Zhongguo Audit Press, 1999)

[10]For example, there were 624 petitions against excessive burdens in Huaiyuan country in Anhui in 1997. (Yep 2004).

test site. The reform was then expanded to other 20 provinces across China at the end of 2002. To take advantage this heterogeneous initiation date, I assign Anhui province as treatment province and Hunan, Hubei, Henan and Jiangxi as control provinces.[11]
The major adjustment of the reform is to substitute collection of local fees by a single agricultural tax. More specifically, the pilot scheme in Anhui consisted of following key components:

1. Decrease per capita lump sum fee, that is, $\Delta F < 0$. Prior to reform, peasants in rural area were subjected to five major township levies (wu tong), three major village levies[12] (san ti) and slaughter-tax, which was a lump sum fee applied to all the local residents irrespective their involvement in poultry industry. Reform abolished all of those, along with most existing pooling funds, government funds and other forms of administrative fees or charges. The only form of charges that is allowed is funds financing some public good provisions in the village. However, it can be only imposed after democratic agreement of villagers (yi shi yi yi).

2. Increase agricultural tax, that is, $\Delta A > 0$. To compensate the loss of revenue of local government, central government readjusted the agricultural tax rate. Prior to reform, the nominal agricultural tax rate τ^A was around 15%. However, since expected output y^A was severely underestimated based on 1960s record, the real tax rate was around 2-3%.[13] The reform re-establishes agricultural tax rate τ^A to be 7%, with possible minor adjustments across regions. Meanwhile, expected output y^A is estimated based on the output level from year 1993 to 1997.[14]

3. Prior to the reform, each rural laborer was required to provide 10-20 days of labor a year, or its monetary equivalent, for water conservation and other public construction. The reform is to gradually phase out compulsory labor obligations and its monetary equivalent over three years.

[11]Further details regarding choice of control provinces and comparability between treatment group and control group are presented in section 3.3.1.

[12]Those charges were collected on a per-capita basis where household size is calculated as the number of individuals in the household registration book. Township levies are mainly used to finance expenditure on local education, militia training, road construction and maintenance, welfare for veterans, and birth control; village levies are for financing remuneration of village cadres, social relief and administration expenses.

[13]Source: Chinas Financial Year Book 2000. Ministry of Finance.

[14]The basic principle is that expected output should reflect level of household agricultural production in a normal year. The specific formulae may vary with regions.

Hence, the change in total tax payment is

$$\Delta T = \Delta(\tau^A y^A) \times l + \Delta F \times n$$

First of all, $\Delta(\tau^A y^A)$ is positive and ΔF is negative. Therefore, the sign of ΔT is generally ambiguous. Moreover, since y^A represents the expected output estimated from pre-specified period, this change in total tax payment is independent of current period labor supply decisions. In addition, there are heterogeneous treatment effects for households with different registered size and contracted land ownership. Enforcement of the reform is the prerequisite for any potential behavioral response. There are plenty of evidences suggesting that the reform is well-implemented. First, to facilitate the reform, central government exerted paramount effort on explaining its rationale and components to village administrations and rural households. Anecdotal evidences indicate that majority of targeted population were aware of the detailed information. Second, to decrease the resistance from local governments, central government partially subsidized the loss of revenue by direct transfers and extra increase in investment in education. Third, numerous previous studies on the subject (for example, Yep (2004), Guo (2003), Pan (2004), Don (2003), Li (2006) and Kennedy (2007)) explored both descriptive and quantitative evidences and all conclude that the effect of the reform was apparent from very start.

Figure 3.1 and 3.2 provide some further evidences at provincial level. Figure 3.1 plots the provincial fiscal revenue from agricultural taxation of treatment and control provinces respectively from year 1998 to 2001, where vertical line indicates the timing of the reform. As expected, agricultural tax revenue hiked for Anhui province at year 2000 and remained roughly at the same level afterwards. In contrast, there were relatively little changes of agricultural taxation for control provinces from 1998 to 2002. Figure 3.2, on the other hand, plots the corresponding provincial extra-budgetary revenue. It can be seen that treatment group and control group share the same trend before the reform. However, from year 2000 when the reform was introduced, extra-budgetary revenue in Anhui province started to decrease while increasing tendency persisted in control group. Although informal charges on rural households are not the only component in extra-

budgetary revenue,[15] the divergence of the trend between two groups still shed light on the enforcement of the reform.

The identification strategy in this paper relies on the assumption that Anhui province was exogenously assigned as the test site by the central government. In particular, Anhui was not targeted due to systematic difference that may result in different trends of outcome variables. Although there is no official statement regarding the underlying rationale of the choice, several indirect evidences indicate that this assignment is plausibly exogenous. First, Table 3.1 compares several observable characteristics of treatment group and control group, and the results suggest that two groups are extremely similar in many aspects. Therefore, it is unlikely that the decision is driven by particular observable characteristics. Second, given the rationale of the reform, central government may want to target on the area where the informal charges were more excessive or tax collection was less sufficient. Moreover, central government may also want to ease the potential social unrest by targeting on the area where the total tax payment was higher. To examine whether this is the case, I regress a dummy variable of reform on several potentially influential tax payment measures. Results are reported in Table 3.2. It can be seen that none of the coefficient is significant, nor any independent variable have predictive power of the reform.

Despite of lack of official claim, scholars and reporters[16] generally attribute the assignment to the following two reasons. First, Anhui was where the Household Responsibility System C one of the milestones that characterized the start of Chinese economic transition - originated. Official documents compare the Tax-for-Fee reform as the current Household Responsibility System and therefore may regard Anhui province as the best test ground drawn from this experience. Historically, Household Responsibility System was initiated by a group of peasants due to low productivity and drought. It was secretly implemented in one collective for over a year before its further expansion and confirmation from central government. Therefore, for other collectives in Anhui the implementation of Household Responsibility System, and thus the current Tax-for-Fee reform is exogenous. Second, another argument suggests that Anhui was chosen because some villages

[15]Extra budgetary revenue includes revenue of administrative and institutional units, revenue of funds, revenue from fundraising programs of township government, revenue of State-owned enterprises and its governing department and other revenues.

[16]See, for example, Guo (2003), Pan (2004), Li (2006), Anhui Daily 5 June 2002.

in Anhui conducted the most comprehensive and systematic pre-reform voluntary pilot scheme. If this is the case, for villages without any pilot scheme the assignment is simply because they happen to be in the same province as those voluntary ones, which is exogenous. Particularly, I observe precise initiation date of the reform at the village level and I explicitly exclude those that started the reform before the year 2000. One might worry about the spill-over effect: both labor market adjustments and information flows in test villages may induce behavioral responses in others, even in the absence of the reform. However, the pre-reform data for the analysis is as early as 1995, when only one county (Taihe) in Anhui province initiated the pre-reform scheme. Also, the sample in the data is geographically dispersed and household registration system in China severely restricts the mobility of rural households. Therefore, it is unlikely that spill over would be a great concern.

Several related questions are important in this study. First, do the households in the treatment group view reform as permanent? Highly likely. In the document issued by the central government, stability of the reform was particularly emphasized. For example, government stressed that "the current land contractual relationship will remain stable for long-term".[17] Similar statements were also issued for assignment of expected output and tax price. Moreover, Tax-for-Fee reform bears a close resemblance in and has been largely compared to the household responsibility system reform. The latter also proceeded as voluntary tests in some counties, then a pilot study in two provinces and finally the whole scale reform. Rural households are likely to draw upon from this experience and regard the current tax-for-fee reform as permanent.

Second, do the households in the control group anticipate the reform and thus change their behavior even in the absence of the reform? Very unlikely. Central government never issued any document regarding the time line of the reform extension. Also, this specific decision depends on multiple factors, such as results of the pilot reform and resistance from the local government. Therefore, although households in the control group may expect the reform to be implemented at some point, the exact starting date remains arguably exogenous.

Third, does the reform results in the change of registered household size? Since it is

[17] According to "Rural Land Contract Law" Article 20, contracts for arable land will not change for 30 years; for grassland 30 to 50 years; for forest land 30 to 70 years. Longer contracting time is negotiable.

highly correlated to the total tax payment, one might worry that households deliberately alter this measure. However, the household registration system (hukou) in China rules out this possibility. Specifically, the transformation from rural to urban registration is extremely difficult. Current criteria are almost totally geared towards the individuals with extensive wealth[18] or the ones with college degree or professional qualification, which is irrelevant to ordinary peasants. Therefore, rural to urban migration is rarely permanent with the alteration of registered status.

Fourth, does the reform induce a decrease in the taxable land area? In particular, households may deliberately reduce the expected output and contracted land area prior to the reform if the formula for agricultural tax calculation is known. However, most rural households renewed their land contract around 1994 in the second round of land contracting movement, when the idea of reform was just burgeoning. Moreover, the estimation of expected output is based on output of 1993-1997, which was also too early for majority of rural households to be aware of the incoming reform. In addition, this baseline was determined after a province-wide reassessment of land productivity and land distribution in 2000. It is impossible for rural household to anticipate this formula beforehand. On the other hand, official document emphasizes the taxable land area would remain constant throughout the contracting period (normally 30 years for the arable land). Therefore, it is fixed when the land contract is signed. In particular, even if the land is left fallowed, household is still subjected to agricultural land tax. One might also worry about the two extreme cases: (1) the whole households migrate to urban area; (2) individuals who do not migrate decease. First, as demonstrated above, permanent migration is extremely difficult. This is particularly so for the whole households. Second, if no clear contracted households can be identified in the case of deceasing, village authority has the right to exploit the land and reclassify the property right to collective. This is suboptimal if there are still members in the households who do not permanently migrate to urban area. Despite of the agricultural tax, land ownership is associated with various entitlement of welfare in rural area, such as dividend in collective enterprises, various form of agricultural compensation and the land for homestead. In contrast, temporary migrants are deprived from basic welfare and government-provided service, such as the right to enroll

[18]It normally requires the ability to purchase to top-end apartment in the market or to be a major investor (Chan and Buckingham, 2008)

the children in public schools in the urban area. Therefore, if possible, rural household is normally unwilling to abandon the land entitlement unless permanently migrated.

3.2.3 Data

The micro-level analysis uses the data from Chinese Household Income Project (CHIP) 1995 and 2002. In both waves, a wide range of demographic and economic variables at individual and household levels are available. All individuals can be linked to the corresponding households and villages by a specific identifier. In addition, 2002 survey include a village administrative questionnaire, in which head of the village committee, party branch secretary or the village accountant reports various village level information. In both survey years, the sample was randomly selected by the National Statistical Bureau of China. It is a repeated cross sectional data and thus does not trace particular households. The original sample covers both rural and urban area in 19 provinces. For the purpose of my study, I restrict attention on rural area of 5 provinces: Anhui, Hubei, Hunan, Henan and Jiangxi. Further, I exclude villages that voluntarily conducted Tax-for-Fee reform before year 2000. The final sample consists of 330 and 1950 households in treatment and control group respectively in 1995 survey, and 300 and 1930 households in treatment and control group in 2002 survey.

On the other hand, aggregate analysis uses information from statistical year book. Specifically, Rainfall data in section 3.5 are recovered from provincial statistical year book.[19] Other provincial level numbers are drawn from China statistical year book by National Bureau of Statistics.

3.3 Estimation of Basic Treatment Effects

3.3.1 Treatment Group and Control Group

Heterogeneous initial dates of the reform provide an opportunity to establish the causal relationship between the reform and household labor supply decisions. Specifically, I apply a difference-in-difference approach with Anhui as the treatment province and Hunan,

[19]For further details, see the description in appendix.

Hubei, Henan and Jiangxi as the control group. The choice of the control provinces are mainly based on their geographical and economical resemblance to the treatment. Figure 3.3 indicates the studied region in China. Geographically and economically, all the five provinces are traditionally grouped together into Central China (Economic) Zone. In particular, I deliberately exclude coastal provinces with substantially higher economic growth rate and per capita GDP than treatment province.

I further assess whether control group is truly comparable to treatment province by examining some observable characteristics at both individual and household level. Summary statistics are reported in Table 3.1. Reassuringly, most differences of examined measures are statistically insignificant between two groups. The only exception is educational attainment, where the control group displays a slightly higher level of education both in years of education and highest educational achievement. Moreover this difference is entirely driven by female. Although this is not ideal, I argue that this difference is against the trend that lump sum tax hike encourages the shift away from agricultural sector to nonagricultural sector. Indeed, Yang (2004) uses the relaxation of controls on allocation of inputs in China to show that schooling enhances farmersability to devote labor and capital to nonfarm production.

3.3.2 Change in Total Tax Payment

I begin by examining the impact of treatment on the total tax payment at household level. As described in section 3.2, the tax reform changes the total tax amount by decreasing the per capita lump sum and increasing (per unit land) agricultural tax. That is,

$$\Delta T = \Delta(\tau^A y^A) \times l + \Delta F \times n = \Delta\Gamma \times l + \Delta F \times n$$

where ΔT, $\Delta\Gamma$ and ΔF are the changes in total tax payment, (per unit land) agricultural tax, and per capita lump sum fee respectively. l is the contracted land area and n is the registered household size. Because $\Delta\Gamma$ is positive and ΔF is negative, the sign of ΔT is largely determined by the corresponding values of l and n. On the other hand, we would expect very different behavioral response for the household with an increase in total tax payment from those with a decrease. Therefore, it is reasonable to divide the population

into two groups based on sign of ΔT.

indent Unfortunately, only repeated cross sectional data is available, which makes it impossible to precisely identify the amount of ΔT. I deal with this problem by estimating the cutoff using the available information. First, I pin down the value of $\Delta\Gamma$ and ΔF by regressing the equation of the following form:

$$(1) \qquad y_h = \alpha + \beta_1 treat_h + \beta_2 post_h + \beta_3 (treamt_h \times post_h) + \delta X_h + \epsilon_h$$

where y_h is the specified tax payment for household h, $treat_h$ is a dummy variable for treatment status, $post_h$ is a dummy variable for post-reform, X_h is a vector of controlled covariates, and ϵ_h is the corresponding error term. All the monetary variables in 1995 are deflated by rural Consumer Price Index to reflect 2002 price level. The first two columns of Table 3.3 presents the regression results where the dependent variables are (per land area) agricultural tax and (per capita) lump sum fee respectively. Theoretically, both measures are allowed to vary across regions and thus they are unlikely to be precise numbers. On the other hand, however, the studied areas are geographically and economically similar and there is no reason to expect a huge variation. These facts are reflected by coefficients in column (1) and (2). The average increase of unit agricultural tax is 36.88 Yuan for treatment province while the average decrease of per capita lump sum fee is 15.03 Yuan. Moreover, the 95 percent confidence intervals are (-19.244, -10.819) and (31.132, 42.629) respectively.

Then, I predict the cutoff based on the set up of the reform. Since $\Delta T = \Delta\Gamma \times l + \Delta F \times n$, then $\frac{\Delta T}{n} = \Delta\Gamma \times (\frac{l}{n}) + \Delta F$. Two conclusions can be drawn from this formula: (1) $\frac{\Delta T}{n} > 0$ if and only if $\frac{l}{n} > -\frac{\Delta F}{\Delta\Gamma}$. This is equivalent to $\Delta T > 0$ if and only if $\frac{l}{n} > -\frac{\Delta F}{\Delta\Gamma}$; (2) $\frac{\Delta T}{n}$ is a strictly increasing function of the land-household size ratio $\frac{l}{n}$. From 95 percent confidence interval of ΔF and $\Delta\Gamma$, we have $-\frac{\Delta F}{\Delta\Gamma}$ belongs to the interval (0.25, 0.61) and its average value is 0.41. This specifies the range of the cutoff.

Finally, I use the survey data to check whether the predicted threshold indeed fits the reality. First, I examine the change in per capita tax payment for different range of value r, where r equals to $\frac{l}{n}$ the ratio between contracted land area and registered household size. (I will use this notation for the remaining of the paper). As argued above, $\frac{\Delta T}{n}$ should increase with respect to r and the positive/negative cutoff should be in the interval (0.25,

0.61). Table 3.10 reports regression results where y^h is the per capita tax payment and households are grouped based on different range of r. Among the chosen endpoints, 0.61 is the upper bound of the cutoff point whereas 1, 1.35 and 2 are the 30, 50 and 75 percentile of r respectively. The choices are made to avoid relatively small sample size of the subgroups which may render the results imprecise. Coefficients in column $(1) - (5)$ generally display the expected increasing trend and the sign. I further divide the first group into two subgroups using the lower bound 0.25 of cutoff as the threshold and report the results in column (6) and (7). The increasing trend and negative sign is preserved with this further refinement. However, relative large variances make the coefficient no longer significant. Therefore, I choose 0.61 as the cutoff point to divide the population into two groups for all the remaining analysis. The advantage to choose upper bound instead of the mean is to avoid a relatively small subsample size for the households with small r. However, we may also include households with positive ΔT in this group.

Based on this chosen cutoff, I further examine the change in total tax payment and results are reported in Table 3.3. Specifically, column (3)-(5) present the results for the change in the amount of total payment for the whole sample, households with r smaller/greater than 0.61 respectively. As expected, for the former subgroup the average total tax payment decreases by 35.91 Yuan after controlling for the household characteristics, although it is not significant. On contrary, the average increase for the latter group is 256 Yuan and significant at the 5 percent level. Column (6)-(8) further examine the change in the percentage of total tax payment relative to total household income. Again, two groups shows very different pattern. Households with r less than 0.61 experience an insignificant change in this measure. Meanwhile, the corresponding coefficient for their counterpart is 2.275 and is significant at 1 percent level. Finally, column (9)-(11) report the change in the percentage of total tax payment relative to household self-reported disposable income. Again, this change for the former group is not statistically significant while the increase for the latter group is 4.9 percentage points. Those results verify the chosen cutoff for ΔT and shows that households are affected very differently based on the ratio between land area and household size.

3.3.3 Treatment Effects on Labor Supply Outcomes

Before going to the detailed analysis, I first provide suggestive evidence that the reform induce a shift away from agricultural sector in the treatment group. Specifically, Figure 3.4 plots the percentage of individuals whose prime job is in agricultural sector at provincial level, and the vertical line indicates the timing of the reform. It can be seen that throughout the period, treatment group and control group share the same downward trend except for the reform year. However, prior to the reform the measure in treatment group is constantly larger. This gap literally disappears in the year of the reform when the statistics in control group increases while the decreasing trend in treatment group persists. The difference between two groups remains roughly zero afterwards.

I then use household level data to further examine the treatment effect on several labor supply outcomes. I define household sector-specific working days as the summation of corresponding working days of all household members between 16 and 60. The lower bound is chosen because compulsory school law in China enforces individuals to stay in the school after completion of grade 9. Majority of population satisfy this requirement by the age of 16. On the other hand, age 60 is the official retirement age for most wage earners.[20]

I first focus on participation rate defined as the proportion of households who report positive working days in specific sector. Specifically, I estimate the equation (1) with y^h being sector-specific participation rate for household h. Registered household size and contracted land area, along with other household characteristics, are controlled in all regressions. Column (1)-(8) in Table 3.4 report the change of participation rate in labor force, only in agricultural sector, in both sector and only in nonagricultural sector respectively. For households with r smaller than 0.61, none of the coefficient is significant indicating limited behavioral response to the reform. This is consistent with the fact that these households are hardly affected with insignificant change of total tax payment, as shown in Table 3.3. On the contrary, there is an obvious shift away from pure farm production to a combination of agricultural and nonagricultural production for households with r greater than 0.61. Specifically, the decrease in proportion of households only

[20]Both compulsory school law and retirement policy is stipulated by state council and is implemented nationwide. There is no evidence that they differ systematically between treatment group and control group.

involved in agricultural sector is 12.8 percentage points larger in treatment province. Meanwhile, the corresponding increase for both sectors is 12.7 percentage points larger. On the other hand, there is no significant difference in the involvement of pure nonagricultural sector between treatment province and control group. This is largely reflect the fact that households are generally reluctantly to give up the agricultural production entirely, despite of their ever increasing involvement in nonagricultural sector. Column (9)-(12) examine participation rate for a more general division of (non)agricultural sector, without distinguishing households only in a single sector from those in both. It is an even clearer demonstration that households affected by the reform move aggressively to nonagricultural sector while pertain the original agricultural production.

Table 3.5 then look into the treatment effects on household sector-specific working days, conditional on reporting positive days in corresponding sectors. Again, the analysis is done separately based on ratio between contracted land area and household size. As expected, two groups exhibit very different behavioral response. For household with r smaller than 0.61, most coefficients are negative and insignificant. The only exception is the average working days in nonagricultural sector increase slightly for households involved in both sectors, though the coefficient is not statistically significant. This again echoes with the fact that reform insignificantly decreases total tax payment for those households. The negative sign is in accordance with standard economic theory that agents tend to substitute leisure for labor if income increases. On contrary, results for the other group reveal an entirely different story. As shown in column (2), reform induces a dramatic increase (258.6 days) in the total working days for this group. Moreover, this difference is mainly driven by the households involved in both sectors. Their total working days increase by 347.3 days with 236.8 and 110.5 days from nonagricultural and agricultural sector respectively. In contrast, households who only involve in agricultural sector decreases their conditional working days by 89.51, significant at 5 percent level. I omit the comparison for households who only involve in nonagricultural sector because the extremely small sample size renders the analysis impossible. There are several possible explanations for the above results. For one, the increase in total working days may be attributed to income effect: households work more to compensate for the increasing total tax payment. For the other, sector-specific difference may reflect a composition

effect resulted from positive or negative selection. For example, it is possible that households who remain only in agricultural sector are among the most productive ones in farm production.

3.4 Theoretical Framework

The above empirical results show that treatment induces a shift away from pure farm production. On the other hand, both $\Delta\Gamma$ and ΔF are independent of current period decision, and l and n are fixed before the reform as argued in section 3.2. Therefore, the only effect of the reform, in essence, is to change households' total lump sum tax payment. This contradicts to the standard theory prediction that the reform should create no distortion in marginal product of labor for both sectors. Consequently, the presence of this shift requires a new explanation, an issue I address in this section.

Agricultural production is always characterized by large risk due to its heavy reliance on weather conditions. This is particular true in the studied region where the major crop of the area is rice, which extremely sensitive to rainfall conditions, and East Asian monsoon is the major determine force for the dry and wet seasons. For example, in the village administrative questionnaire, 53.8 percent and 65.4 percent of the villages report suffering from natural disaster in 2002 and 1998 respectively. The average losses in agricultural income for such villages are 13.4 percent and 21.6 percent. In comparison, nonagricultural income is much less riskier: wage profile in most cases remains relatively stable over short-run.

Risk in agricultural production would not be a problem if household have sufficient access to market or nonmarket institutions for the exchange of risks, independent of risk aversion. However, this is an extraordinary assumption for rural China. Formal financial markets in the region provide only limited, if any, spreading and pooling of production risks. Nonmarket institutions, such as remittances and private transfers, are generally incapable of full insurance against aggregate risk, say, a large scale natural disaster. In fact, Jalan and Ravallion (1999) use a panel data to test risk insurance model in the rural China. The hypothesis of perfect insurance is universally rejected, with the strongest rejection occurs at the poorest wealth decile where 40 percent of an income shock passes

onto current consumption.

These perceptions suggest that risk in agricultural income could potentially be important factors in explaining observed shift. The intuition goes as follows: the reform increases the total amount of lump sum tax payment for certain households. Therefore, households become more risk averse under decreasing absolute risk aversion (DARA) assumption,[21] and thus view agricultural production as riskier, even the absolute value of the variance remain the same. In essence, the reform lowers the marginal product of labor in agricultural sector by implicitly increasing its marginal risk premium. Consequently, households change sectors to substitute the risky income with an income source of less risk. In the remaining of the section, I provide a simple model to formally illustrate the idea, and suggest dimensions along which to examine the heterogeneity of treatment effects.

Consider a one-period model with two sectors: agricultural and nonagricultural. The agent has a fixed endowment of land T and one unit of time which can be allocated in agricultural sector (e) and nonagricultural sector (h) respectively. The wage rate w in nonagricultural sector is predetermined by agents characteristics, such as education level and years of experience. Let the production function in agricultural sector be $F(e,T)$, where $F : R_+^2 \to R_+$ is continuously differentiable, strictly increasing, concave and $F(0,T) = 0$.

First consider the standard model that does not take the risk in farm production into account. Then the agents maximization problem is:

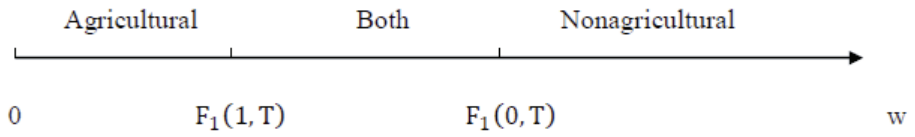
$$\begin{aligned} &\max u(c - \hat{c}) \\ s.t. \quad &c = wh + F(e,T), \quad h + e = 1 \end{aligned}$$

where $\hat{c}$ is the total amount of the subsistence consumption level and obligatory tax payments. Then the first order conditions given an interior solution exists is

$$(2) \qquad w = F_1(e,T)$$

[21] This seems to be a reasonable assumption in rural China where the consumption level is very close to the subsistence level. In fact in the survey, 55.8 percent households report having some living difficulties due to economic reasons and 41.7 percent households claim that the money is not adequate for living expenses.

Since $F(e,T)$ is strictly increasing and concave, then $F_1(e,T)$ is decreasing with respect to e. Therefore, agent's sector choice can be represented in the following line. That is, if $w \geq F_1(0,T)$, agent will only work in nonagricultural sector whereas with $w \leq F_1(1,T)$, agent will only work in agricultural sector. Only if $F_1(1,T) < w < F_1(0,T)$ will the agent work in both sectors and the sector-specific working time satisfies equation (2).



Since both thresholds are independent of $\hat{c}$, then the reform should not result in any change in sector-specific participation rate if riskless scenario.

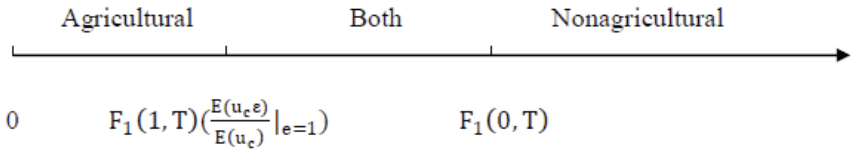
Then I incorporate the risk by introducing a random variable ϵ with positive support and mean 1 in front of the production function. Now the agents problem becomes:

$$\max Eu(c-\hat{c})$$
$$s.t. \quad c = wh + \epsilon F(e,T), \quad h+e=1$$

which gives the first order condition for an interior solution as

$$(2') \qquad w = \frac{E(u_c\epsilon)}{E(u_c)}F_1(e,T) = F_1(e,T) - F_1(e,T)\frac{-cov(u_c,\epsilon)}{E(u_c)}$$

The last term approximately corresponds to the marginal risk premium with respect to effort in agricultural sector, which is the highest amount that agent would pay to be guaranteed the expected value of his marginal productivity (See the appendix for a proof). In particular, under imperfect insurance market, we have $cov(u_c,\epsilon) < 0$ and thus $\frac{E(u_c\epsilon)}{E(u_c)} < 1$. Therefore, agricultural marginal product of labor is taxed due to its riskiness. Moreover, $\frac{E(u_c\epsilon)}{E(u_c)}F_1(e,T)$ is a decreasing function of e (see the appendix for a proof), and thus agents sector choice can be represented by a similar real line where agent will only work in nonagricultural sector if $w \geq F_1(e,T)\frac{E(u_c\epsilon)}{E(u_c)}|_{e=0} = F_1(0,T)$ and in agricultural sector if $w \leq F_1(1,T)\frac{E(u_c\epsilon)}{E(u_c)}|_{e=1}$. Only if $w \leq F_1(1,T)\frac{E(u_c\epsilon)}{E(u_c)}|_{e=1} < w < F_1(0,T)$ will the agent work in both sectors and the time allocation satisfies equation (2').



Now, the change of lump sum tax influence sector choice through the term $\frac{E(u_c\epsilon)}{E(u_c)}$. Specifically, if decreasing absolute risk aversion (DARA) assumption is satisfied and the consumption level is not very far away from the subsistence level, then $\frac{E(u_c\epsilon)}{E(u_c)}$ is a decreasing function of $\hat{c}$ (see appendix for a proof). Therefore, increasing $\hat{c}$ would decrease $F_1(1,T)\frac{E(u_c\epsilon)}{E(u_c)}|_{e=1}$ and thus results in a trend from pure farm production to a mix of both sectors. In addition, the size of the gap between $E(u_c)$ and $E(u_c\epsilon)$ is an increasing function with respect to the level of risk in agricultural sector under the same insurance conditions.

Above model predicts that the participation in nonagricultural sector is not affected by the reform. However, this fact is entirely due to the assumption that there is no risk in nonagricultural income. It is an extremely strong assumption though. For example, self-employment in nonagricultural sector is also subjected to great risk. In addition, a large proportion of wage earners are under a short-term or temporary contract, if any. We can conveniently incorporate the risk in nonagricultural income by introducing a random variable μ with positive support and mean 1 in front of the wage rate. Then the reform will also distort the marginal product of labor in nonagricultural sector. However, as long as the variance of μ is smaller than the variance of ϵ, that is, nonagricultural income is less risky, the shift from agricultural sector to nonagricultural sector should still be preserved. Furthermore, we can also incorporate leisure into the model to relax the model prediction that total working time remains fixed. The derivation and conclusion is similar and I omit further details.

3.5 Heterogeneous Treatment Effects

The pattern of heterogeneous treatment effects can give us information on two aspects. First, it can further verify whether the observed behavioral response is indeed due to the treatment. As in section 3.3, I conduct all the analysis for two groups who are differently

affected by the reform. Theoretically we should expect substantial differentiation in behavioral response. Second, further analysis can reveal whether change of absolute risk aversion is among the potential channels through which the treatment exerts its influence. In particular, theory suggests that treatment effects should be larger for households facing greater risk. Also, if absolute risk aversion indeed changes, so would be corresponding risky behavior. In the rest of the section, I am going to provide some empirical evidences regarding these two aspects. I am going to particularly focus on treatment effects at extensive margin, i.e. sector-specific participation rate. This is mainly because relative to conditional working days, this measure has a clear interpretation.

3.5.1 Self-Employment versus Wage Earning Employment

In this section, I examine the treatment effects on nonagricultural self-employment and wage earning employment. One of the significant characteristics that distinguish the two is the riskiness of the income: the former is much riskier in most cases. First, self-employment always requires a substantial amount of initial investment: 2002 survey reports an average startup investment 4807 (2002) Yuan for nonagricultural production. This number can be compared to the average self-reported household disposable income 9851.38 (2002) Yuan. Furthermore, the self-employed enterprises in rural China are always of very small scale (Zhang et al 2006), where the majority of employees are family members or relatives. In addition, majority of households classify their nonagricultural business as communication, trade, restaurant and catering in the survey, whose profit is usually very sensitive to market price and demand.

Consequently, if heterogeneity in income risk is indeed one potential explanation, then participation rate in self-employment would be affected differently from wage earning sectors. Specifically, theory predicts a smaller shift towards nonagricultural self-employment, if at all. The empirical strategy is the same as before. Table 3.6 presents the regression results. Column (1) and (2) examines the participation rate for nonagricultural self-employment or wage earning activities. Consistent with previous nonagricultural sector participation results, there is no significant difference for households with r smaller than 0.61 between treatment and control. Meanwhile, it is 14 percentage points higher in treatment province for households with r greater than 0.61. Column (3)-(8) conduct further

analysis based on whether the households only involve in self-employment/wage earning jobs or both. Again, there is a stark contrast between households with different range of r. For households with smaller r, most coefficients are insignificant indicating there is no systematical difference in change of those participation rates between treatment and control provinces. Moreover, column (3) reports a positive coefficient for participation in pure self-employment. On the other hand, it is evident that households with larger r have a tendency to increase their wage earning employment. Specifically, the participation rate for self-employment (only) decreases by 5.6 percentage points in treatment province and is significant at 10 percent level. In contrast, involvement in both categories and wage earning employment increases by 5 and 14 percentage points respectively relative to control group.

3.5.2 Risk in Agricultural Production

The agricultural production faces great risk. For example, it relies heavily on the weather conditions. This is particularly true in the studied area where rice-famous for its stringent requirement of rainfall and irrigation conditions-is the major crop. Moreover, heterogeneous weather condition across the region makes farm production riskier for some households than others. This provides an opportunity to test the hypothesis that change in risk aversion is among the potential channels that induce households labor response. Specifically, theory predicts that households facing higher level of uncertainty in agricultural income should be more likely to shift away from agricultural sector under treatment. To formally conduct the test, I estimate the following equation

$$
\begin{aligned}
(3) \qquad labor_h = {} & \alpha + \gamma_s(treat_h \times post_h \times risk_{hs}) + \beta_1 treat_h + \beta_2 post_h + \beta_3(treat_h \times post_h) \\
& + \rho_s risk_{hs} + \phi_s(treat_h \times risk_{hs}) + \psi_s(post_h \times risk_{hs}) + \delta X_h + \epsilon_h
\end{aligned}
$$

where $labor_h$ is the interested labor supply outcomes for household h, $treat_h$ and $post_h$ are the dummy variables indicating treatment status and post-reform respectively. $risk_{hs}$ is a dummy variable representing risk characteristics s for household h, which will be defined below. X_h are the controlled characteristics of household h. Our interested parameter is γ_s, which demonstrates how the treatment effects vary with risk characteristics s. Be-

cause the labor supply response may vary over time and region even in the absence of treatment, I allow post-reform and region effect also differ along risk by including all the pairwise interaction terms.

Several risk measures are used in the regression. I construct the first set of risk dummies by taking advantage of the fact that agricultural tax is calculated based on expected agricultural output under "normal" years. In particular, the amount is pre-specified and thus is independent of current period labor supply decision. More specifically, I first predict the expected agricultural income by a linear model of agricultural tax and other observed characteristics. Then I regard the agricultural income as abnormal if the self-reported value is smaller than the lower bound of 99 percent confidence interval of the predicted value. I choose this confidence level to deliberately allow potential underestimation of the abnormality in agricultural income, and thus it is likely to work against proposed theory. I repeat this exercise for the year 1991-1995 and 1998-2002.[22] Finally, I construct the dummy variable to indicate whether household has abnormal agricultural income more than once for the past five years. The second risk dummy is constructed based on self-reported number of natural disasters. Similarly, I construct the dummy variable to indicate whether household suffered from natural disaster more than once in the past five years. I avoid further division regarding risk status in agricultural production for the consideration of sample size. Since the analysis will be conducted for households with different value of r, further grouping renders the obtained coefficient less credible. Let 1 be the coefficients for the risk dummy variables. Without perfect insurance market, the theoretical model predicts that treatment effects should be larger for households facing greater risks.

However, neither of the above measures is ideal. One of the greatest concerns is that both dummy variables may not be entirely exogenous. In particular, misreporting is likely to be a problem. First, both measures rely on reminisces (of agricultural income, disposable income and natural disaster status) for the past five years. This may introduce large measurement error. Second, households may deliberately misreport in the survey. For example, if households view the survey as a potential opportunity to influence the distribution of government calamity relief or other kinds of transfers, there is an incentive

[22]In the dataset, households report disposable income for the past five years by reminisces.

to over-report the natural disasters status or underreport household disposable income. In addition, there is no clear cutoff for the classification "natural disaster". It is possible that more risk-averse households are more inclined to report natural disasters. Even without misreporting issue, the constructed dummy variables could still be correlated to the error term. For example, under the same level of risk households may react differently due to unobservable characteristics and thus result in different level of disposable income.

One possible way to restore exogeneity is to use the rain fall record as a proxy for natural disaster. The major crop in the studies region is rice,[23] which is generally grown as a wetland crop in fields flooded to supply water. On the other hand, both treatment group and control group have an alternating dry season and wet season climate pattern, the duration of which is mainly determined by monsoons. Consequently, drought and flood are common in the area. Therefore, I use the standard deviation of annual rainfall as a proxy for riskiness of agricultural production. However, the available metrological data is not ideal. I only manage to obtain county level rain fall record of 3 out of 5 provinces (Anhui, Hunan and Jiangxi) for later period.[24] Therefore, I have to make the assumption that the climate pattern is relatively stable and later record is a good proxy for the studies period. Then, I estimate the equation

$$(3') \qquad labor_h = \alpha + \gamma_s(treat_h \times post_h \times STD_s) + \beta_1 treat_h + \beta_2 post_h + \beta_3(treat_h \times post_h) + \beta_4 STD_s + \phi_s(treat_h \times STD_s) + \psi_s(post_h \times STD_s) + \delta X_h + \epsilon_h$$

where s is the index for the county s, STD_s represents the standard deviation of annual rain fall in county s. Other notations are the same as in equation (3). Theory predicts that γ_s should be negative for participation in pure farm production. Since available rainfall record is very crude, I take the evidence here only as suggestive.

Before I present the empirical results, I discuss briefly about the comparison of three risk measures. Assume that all the variables are measured without error, we should expect largest discrepancy of treatment effects using first measure of risk and smallest using the rainfall record. This is because natural disaster is only one potential factor of low agricultural income. At the same time, it is a much broader category than abnormal

[23]The sowing area of rice production counts for 84 percent of the total sowing area of grain in five provinces studied. Source: China statistical year book (2002).

[24]See appendix for further details of availability regarding rainfall record.

rainfall. However, as argued before, measurement errors are likely to be large. In addition, insurance market may differ systematically among different groups. In particular, if households with higher risk also have better access to insurance institutions, estimates will be attenuated.

Table 3.7 examines the change in participation rate of labor force and pure farm production. Regardless of the risk measure, there is no great difference between treatment and control group in the labor force participation rate. This, in fact, is unlikely to be a responsive margin: almost all households generate labor income. Exceptionally, households suffered from more volatile rainfall are more likely to be in the labor force if r is greater than 0.61. The coefficient is significant at 5 percent level. Column (7)-(12), on the other hand, present the results for agricultural only participation rate. Again, for households with r smaller than 0.61, none of the coefficient is significant. This indicates that neither reform, nor the risk in agricultural production had an impact on the change of agricultural only participation rate. In contrast, households with r greater than 0.61 report a much responsive shift if they are likely to suffer from greater risk in agricultural production. For example, the proportion in pure farm production decreases by 12 percentage points if households have abnormal agricultural income more than once for the past five years relative to their counterpart in treatment province. Similarly, every $100mm$ increase in the standard deviation of rainfall results in a decrease of 10.3 percentage points in the participation rate of pure farm production. Moreover, the coefficient of interaction term between treatment and post dummies is much smaller than that of triple interaction term. The former is actually not significant for the first two risk measures and is only significant at 10 percent level for the third. This shows that observed behavioral response is largely driven by the households who suffer greater risk in agricultural production.

Table 3.8 reports the results of change in participation rate for both sector and pure nonagricultural sector. For households with r smaller than 0.61, all the coefficients are not significant at 5 percent level, consistent with the fact that they are hardly affected by the reform. For households with r larger than 0.61, all the coefficient for the interaction term between treat and post are not significant. This indicates that households with little risk in agricultural production do not respond actively to the reform. On contrary, the coefficients of triple interaction term reveal a dramatic increase in the participation

rate of both sectors. For example, households who report more than one natural disaster in the past five years have a 12 percentage points higher participation rate in both sector compared to those who report zero or only one. In addition, most coefficients are insignificant regarding nonagricultural only participation. The only exception is there is slight decrease in this measure for households facing larger rainfall variation.

3.5.3 Savings

Savings is often due to precautionary purpose in developing countries, that is, to offset the potential income fluctuation in the future. Higher level of risk aversion generally results in a stronger preference over smooth consumption, and thus a higher level of precautionary savings. Therefore, if treatment alters households absolute risk aversion, we may observe the corresponding change in savings.

First of all, the underlying assumption to use difference-in-difference approach is control group and treatment group shares the same trend. This assumption would be hard to be justified if the income fluctuation differs systematically between two groups. To address this concern, I estimate a simple difference-in-difference regression with dependent variable being self-reported number of natural disasters suffered during the past five years, the (conditional) percentage decrease in agricultural income relative to normal years and the corresponding (conditional) government transfers. As shown in Table 3.11, none of the coefficients is significant and null hypothesis of F-test cannot be rejected in all the cases. This suggests that in the absence of the reform, savings behaviors in two groups are likely to share the same trend.

Followed Paxson (1992), I use three different ways to measure savings. The first measure, denoted as $save1$, is the difference between net income and expenditure on all goods and services. As argued by Paxson, despite of being a traditional measure of savings, $save1$ may result in underestimation due to consumption on durables. This is because durables are not consumed immediately upon purchase, but instead yield a flow of consumption service over a period of time and thus contain a savings component. The second measure $save2$, on the other hand, is defined as the difference between "net

income and expenditure on all goods and services except consumer durables".[25] $Save2$ takes the saving function of durable goods into consideration; however, it overestimates the savings by excluding the consumption from durables in the current period. The third measure, save3, is denoted as the total value of financial and real assets minus the total liability/debt at the end of the survey year.[26] Save3 may suffer from serious measurement errors because the monetary values of many assets/liabilities are self-estimated.

Table 3.9 reports regression results on saving behaviors. I examine the changes of saving in both absolute amount and the percentage relatively to total income. Again, households with different value of r respond very differently. Column (1) and (3) indicates an insignificant change of save 1 and save 2 for households with r less than 0.61. Correspondingly, their percentage changes relative to total income are also not significant. In contrast, reform results a large increase of saving for households with r greater than 0.61. For example, column (2) and (4) report increases of 2116 and 2170 Yuan for save 1 and save 2 respectively. The corresponding increase in percentage term, as shown in column (8) and (10), are 12 and 12.7 percentage points. On the other hand, column (5) and (6) both indicate an increase in save 3 regardless of the value of r, although the coefficient for the first group is not significant. Nor is the ratios of save 3 relative to total income. In addition, magnitudes of these estimates depend critically on household characteristics (results are not reported here). This may reflect the difference in level of financial literacy and large potential measurement errors.

3.6 Robustness Check

3.6.1 Household Size and Land Area

The total tax payment is largely determined by the household size and contracted land area. Therefore, reform may provide incentive for households to change these two margins, for example, to decrease contracted land area and thus reduce the tax payment. However, as I argued in section 3.2, the institutional feature in rural China renders those

[25] In this study, expenditure on consumer durables includes self-reported expenses on durable goods, clothing, education, purchasing or construction cost on housing and fixed capital on production.

[26] Financial assets include cash holdings, checking and savings accounts, stocks, bonds, business investment; real assets include household fixed productive assets, real estate and jewelry.

changes largely impossible. In this subsection, I further examine those margins using difference-in-difference analysis. Quantitative evidences also demonstrate that the reform does not result in any household size and land area changes.

Specifically, column (1)-(9) of Appendix Table[27] report regression results at the household level. I conduct analysis for the whole sample, as well as the two subsamples using previous cutoff. None of the coefficients is statistically significant which echoes the previous argument that it is extremely difficult for households to change the size or contracted land area. The remaining columns present the regression results using information from village level questionnaire. In particular, column (10) and (11) demonstrate that the change in village population and number of household are not statistically significant between treatment group and control group. Column (12) reports the coefficient of regressing number of migrated household from the beginning of 1999 to the end of 2002 on the treatment dummy variable and other controlled village characteristics. Again, it is not statistically significant. Column (13)-(15) examines whether there is any difference in the change of planting area between two groups. None of the coefficients for the total area, grain planting area and vegetable planting area is significant.

3.6.2 Compulsory Labor Requirement

One component of the reform is to gradually phase out compulsory labors over three years. Theoretically, each rural laborer was required to provide 10-20 days of labor a year, or its monetary equivalent, for water conservation and other public construction prior to the reform. This may confound the treatment effect examined in this paper. I address this concern below. First, in 2002 survey, detailed information including required compulsory labor days, actual completed days and monetary equivalent for uncompleted days is reported at the household level. When I construct the measure of (non)agricultural working days, I deliberately do not include completed compulsory labor days into any category.[28] Meanwhile, I incorporate the payment associated with compulsory labor requirement into per capita lump sum fee at the household level. Second, the corresponding measures in 1995 are constructed based on the detailed reports on individual working days for certain

[27]This table is available upon requests.

[28]Please refer to appendix for further information regarding the construction of the variables.

activities. Specifically, agricultural working days is a summation of days spent in various farm and sideline productions; meanwhile, nonagricultural variable is a summation of days working in enterprises/institutions or nonagricultural self-employment. Compulsory labor requirement does not seem to fit into any description. On the other hand, the question I use to construct the per capita fee in 1995 explicitly asked for "the total amount of any collective/village informal and formal per capita charges". Hence households are likely to include monetary equivalent of compulsory labor into this category based on the phrasing of the question.

3.6.3 Labor Demand and Other Possible Confounding Projects

One potential explanation for the observed shift in agricultural labor supply may be the difference in sector-specific labor demand between two groups. For example, treatment province may experience a greater advancement in agricultural technology which reduces the necessary labor input in farm production. Or a faster pace of industrialization in treatment stimulates a greater need of nonagricultural workers. This subsection provides some empirical evidences to address this issue.

First, I conduct a difference-in-difference analysis using the information available at the village level. Column (1)-(3) in Appendix Table[29] examines the change in unit output of rice, wheat and corn. All the coefficients are not statistically significant indicating that there is no systematically difference in the change of agricultural productivity between treatment and control provinces. Column (4) and (5) presents the results on the change in the number of individuals employed out of township for more than one month and six months respectively. This is to address the concern that individuals in the villages with larger migrant worker network are usually more likely to take out-of-township nonagricultural employment (Giles and Yoo, 2007). Again, both coefficients are not significant. Another concern of the labor demand involves TVEs (Township and Village Enterprises), which are public market-oriented enterprises in rural China. They are normally "collectively owned" in the sense that ultimate ownership rights stay with the collective whereas "use rights" are delegated to managers who can be local government or other qualified corporations or individuals. TVEs has been a very vibrant part in the rural economic

[29]This table is available upon requests.

growth and accommodated a large proportion of rural labor force (Balasubramanyam and Fu, 2003). Therefore, any systematical difference in the growth of TVEs would confound the analysis. Column (6)-(7) examine the change in revenue of all TVEs and TVEs owned by the village level collectives. Column (8)-(12), on the other hand, presents results on the number of workers employed by TVEs based on the delegation of "use rights". No evidence points to different growth rates of TVEs between two groups. In addition, column (13) examines whether the foreign/domestic investment differs. The coefficient is again not significant.

Second, I draw upon labor demand information at the provincial level from Statistical Year Book. Figure 3.5 and Figure 3.6 graph the number of all state-owned and non-state-owned above designated size industrial enterprises[30] and their gross output value. It can be seen that treatment province and control provinces share a similar trend in both measurements.[31] Figure 3.7 examines the number of employees in TVEs in rural area. Echoed with household level analysis, the trend in two groups is roughly the same.

Another potential confounding factor is the possible different effects of other projects or public service provision. Although I cannot entirely rule out this possibility, I believe that it is not likely to be a major concern. I draw this conclusion based on the information from the village administrative data questionnaire in 2002 survey.[32] Specifically, I conduct a simple difference-in-difference regression for the change in irrigation condition, public service, whether the village is a pilot village, village level expenditure, and social structure. Regression results[33] indicate that there is no systematical difference in the influence of examined projects or social structures between treatment province and control provinces.

[30]All state-owned and non-state-owned industrial enterprises above designated size refer to all state-owned industrial enterprises plus the non-state-owned industrial enterprises with an annual sales income over 5 million Yuan.

[31]Figure 3.8 to 3.13 graph the same measures for state-owned and state-holding enterprises, collective-owned enterprises and sharing-holding corporation Ltd respectively. Treatment province and control provinces share the similar trend in all the figures.

[32]In this questionnaire, party branch secretary, head of the village committee, or the village accountant were asked about the information regarding public service, investment, village expenses and social structures for both year 1998 and year 2002.

[33]The results are available upon requests.

3.7 Discussion

This section discusses the empirical results and other possible underlying models. First, the results indicate a large shift from agricultural sector to nonagricultural sector in treatment province. Furthermore, this shift is mainly driven by the households with large value of r, who are heavily affected by the reform. There are two tentative additional explanations of why the reform induces such a large behavioral response. First, the main dependent variable examined here-sector specific participation rate-is likely to be a very responsive margin. Since this measure is defined as the proportion of households that report positive working days in specific sector, any change of working days from zero to positive of any household member will cause the binary variable jump from zero to one. Second, affected rural households are highly likely to view this reform as long-term, if not permanent, based on official documents and their experience from Household Responsibility System. Therefore, the reform is equivalent to a permanent income shock and households are likely to take this into account when they maximize their utility.

The empirical results of heterogeneous treatment effect in section 3.5 provides some evidences to support the proposed hypothesis that uncertainty in farm production, imperfection in risk market and decreasing absolute risk aversion resulted from the reform is one explanation for observed difference. However, I do not claim that it is the only underlying model. Another possible model is to assume an upper bound for the time that can be effectively devoted to farm production. Mathematically, there exists a value $\hat{e}$ such that $\hat{e}$ is less than the total time endowment and $F_1(e, T)$ remains relatively large for $e < \hat{e}$ but decreases extremely rapidly for $e > \hat{e}$. This assumption is likely to be justified since farm production relies on other critical conditions such as land quality and technology. Extra labor input would be redundant beyond a certain point if other essential inputs cannot increase simultaneously. Now consider households who involve in farm production prior to reform. It is possible that they exert effort e close to $\hat{e}$ to maximize the agricultural output. Meanwhile, the potential wage rate in nonagricultural sector is relatively low for them to substitute leisure. After the reform, households need extra income to compensate the increasing total tax payment. However, additional labor input in farm production would not yield effective increase in agricultural income and therefore households can only turn to nonagricultural sector for extra income.

This hypothesis can safely explain the observed shift from pure farm production to a combination of two sectors. Also, it fits the observation that shift is larger for households who suffer greater risk in agricultural production if $\hat{e}$ is smaller for such households. However, it is unlikely to be the whole story. First, this hypothesis has some difficulties to explain the change in savings behavior. Second, this theory predicts that households working days in agricultural sector should not decrease. I examine the conditional working days for households who involve in agricultural sector. I choose this category because difference-in-difference analysis indicates that the reform has insignificant effect for general agricultural participation rate. This can reduce the confounding effect of positive/negative selection. The coefficient reveals a 46.48 days (with standard error 22.79) decrease for households with r greater than 0.61 in treatment province. Consequently, it is likely that observed difference is a combined result of several models.

3.8 Conclusion

This paper establishes a causal relationship between labor supply decision and change of lump sum tax. It does this by exploiting the difference in initiation date of a tax reform in rural China and the empirical findings reveal a shift away from agricultural sector to nonagricultural sector. I propose that this phenomenon is due to the uncertainty in farm production, imperfection in risk market and decreasing absolute risk aversion in rural China. Empirical results on heterogeneous treatment largely support this hypothesis. Hence, policy implication is clear: policy makers in developing countries should take the income risk into account before any lump sum tax is imposed. Once the distortive property of the lump sum tax is established, one can explicitly estimate the tax elasticity on labor supply using the same tax reform. Also, it would be interesting to compute the corresponding deadweight loss and compare this measure to that of the standard proportional tax. I will leave these topics to the further researches.

3.9 Appendix

3.9.1 PROOF OF RESULT1

In this section, I establish the result that the term $-\frac{cov(u_c,\epsilon)}{E(u_c)}F_1(e,T)$ approximately corresponds to the agents marginal risk premium with respect to the effort in agricultural sector. Let rp be the total risk premium which is the maximum amount that the farmer would pay for crop insurance. Then

$$u[F(e,t)+w(1-e)-\hat{c}-rp]=Eu[\epsilon F(e,T)+w(1-e)-\hat{c}]$$

Differentiate both sides with respect to effort yields

$$\begin{aligned} u'(Ec-rp)[F_1(e,t)-w-\frac{drp}{de}] &= E[u'(c)(\epsilon F_1(e,T)-w)] \\ &= F_1(e,T)[Eu'(c)+cov(u',\epsilon)]-Eu'(c)w \end{aligned}$$

where

$$c=\epsilon F(e,T)+w(1-e)-\hat{c}$$

Also,

$$u'(Ey-rp)\approx E[u'(y)]$$

Then the marginal risk premium with respect to effort can be written as

$$\frac{drp}{de}=-[\frac{cov(u',\epsilon)}{E(u'(y))}]F_1(e,T)$$

This equation establishes that the marginal risk premium with respect to effort is approximately equal to the last term mentioned in the text. □

3.9.2 PROOF OF RESULT2

In this section, I establish the following result: $\frac{E(U_c\epsilon)}{E(u_c)}F_1(e,T)$ is a decreasing function of e if an interior solution exists for equation (2'). To ease the notation, denote

$$F_1=F_1(e,T), F_{11}=F_{11}(e,T), c'=\frac{dc}{de}=-w+\epsilon F_1, c''=\epsilon F_{11}$$

where

$$c = \epsilon F(e,T) + w(1-e) - \hat{c}$$

Then first-order condition for an interior solution for the maximization problem is

$$E(u_c c') = -wE(u_c) + E(u_c\epsilon)F_1 = 0$$

That is,

$$w = F_1 \frac{u_c \epsilon}{E(u_c)}$$

The second-order condition is

$$\Delta = E(u_{cc}(c')^2) + E(u_c c'') \quad = w^2 E(u_{cc}) - 2wF_1 E(u_{cc}\epsilon) + (F_1)^2 E(u_{cc}\epsilon^2) + E(u_c\epsilon)F_{11} < 0$$

On the other hand,

$$\begin{aligned} \frac{d}{de}[\frac{E(U_c\epsilon)}{E(u_c)}F_1] &= \frac{1}{Eu_c}[E(u_{cc}\epsilon c')F_1 - \frac{E(u_c\epsilon)}{Eu_c}E(u_{cc}c')F_1 + E(u_c\epsilon)F_{11}] \\ &= \frac{\Delta}{Eu_c} < 0 \end{aligned}$$

Therefore, $\frac{E(U_c\epsilon)}{E(u_c)}F_1(e,T)$ is a decreasing function of e if an interior solution exists for equation (2').□

3.9.3 PROOF OF RESULT3

In this section, I establish the result that under decreasing absolute risk aversion (DARA) assumption and if the consumption level is relatively close to subsistence level, then $\frac{E(u_c\epsilon)}{E(u_c)}$ is a decreasing function of $\hat{c}$.

First note that

$$\begin{aligned}\frac{\partial}{\partial \hat{c}}[\frac{E(u_c\epsilon}{Eu_c}] &= \frac{1}{(Eu_c)^2}[-E(u_{cc}\epsilon)E(u_c) + E(u_{cc}E(u_c\epsilon)] \\ &= \frac{1}{(Eu_c)^2}[-cov(u_{cc},\epsilon)E(u_c) + E(u_{cc}cov(u_c,\epsilon)] \\ &= \frac{1}{(Eu_c)^2}[-cov(u_{cc},\epsilon)E(u_c) + E(-u_{cc}cov(-u_c,\epsilon)]\end{aligned}$$

Under DARA assumption, $\frac{-u_{cc}}{u_c}$ is larger under a negative shock and smaller under a positive shock. That is, u_c decreases (increases) slower than $-u_{cc}$ under a positive (negative) shock. Hence,

$$cov(-u_{cc},\epsilon) < cov(u_c,\epsilon) < 0$$

Also, if consumption level is relatively close to subsistence level, it is reasonable to conclude that

$$E(u_c) > E(-u_{cc})$$

Hence

$$\frac{\partial}{\partial \hat{c}}[\frac{E(u_c\epsilon}{Eu_c}] < 0$$

Note that the requirement is sufficient but not necessary for the conclusion. That is, we may obtain the same conclusion with weaker condition.

References

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Figure 3.1: Provincial Fiscal Revenue from Agricultural Taxation 1998-2001

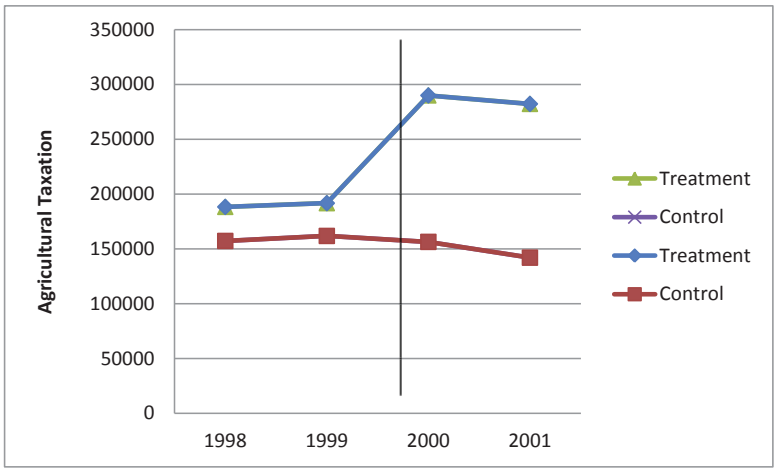
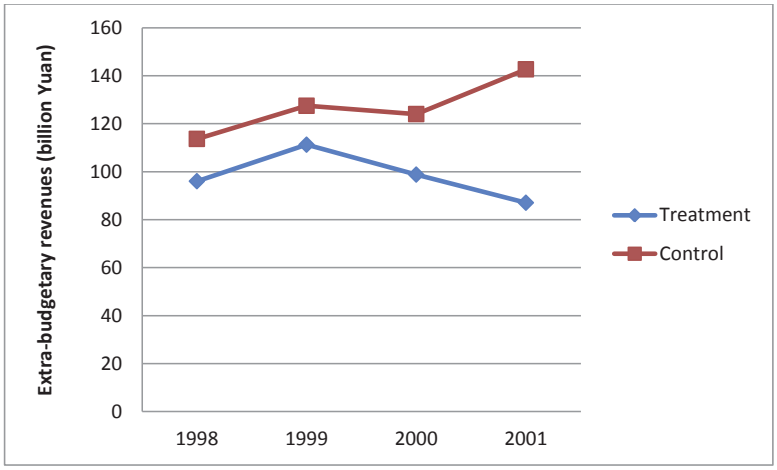


Figure 3.2: Provincial Extra-Budgetary Revenues 1998-2001



Note: All the monetary values are deflated to 2002 Yuan by Consumer Price Index for agricultural households. Treatment province is Anhui province while control provinces include Hubei, Hunan, Jiangxi and Henan. The construction of the measure for control group in Figure 3.1 follows the formula: extra-budgetary revenue in control group = total amount of extra-budgetary revenue × population of control group/ population of treatment province. For Figure 3.2, agricultural taxation in control group = total amount of agricultural tax × number of rural laborer in control group/number of rural laborer in treatment province. Source: China Statistical Year Book 1999-2002 by National Statistical Bureau.

Figure 3.3: Geographic Locations of Treatment and Control Provinces

Figure 3.4: Percentage of Individuals Whose Prime Job is in Agricultural Sector

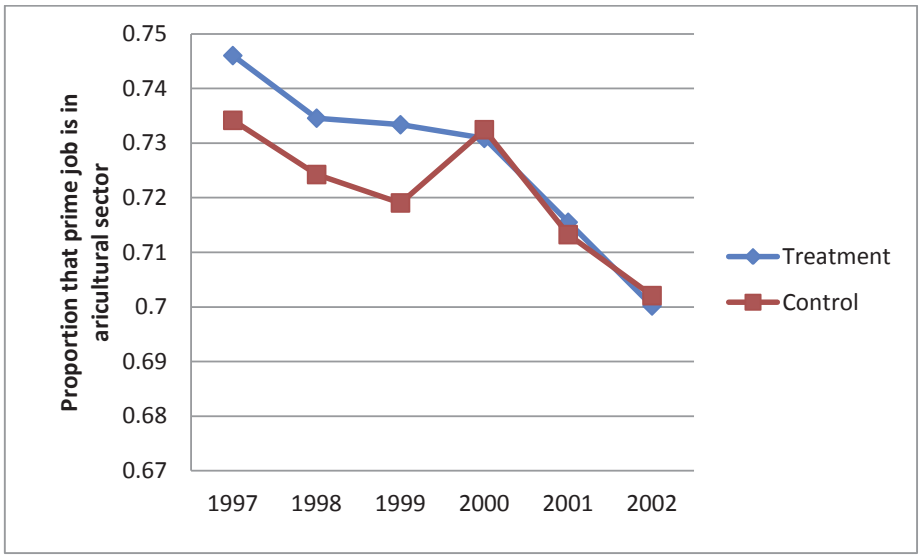


Figure 3.5: Number of All State-Owned and Non-State-Owned above Designated Size Industrial Enterprises

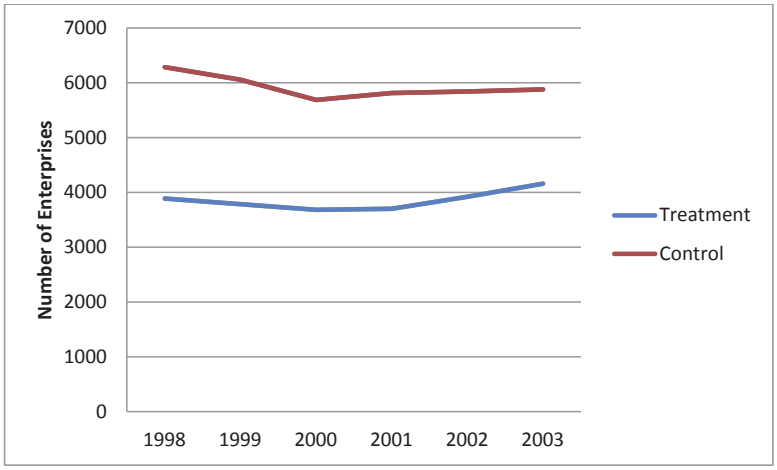


Figure 3.6: Gross Output Values of All State-Owned and Non-State-Owned above Designated Size Industrial Enterprises (1990 Yuan)

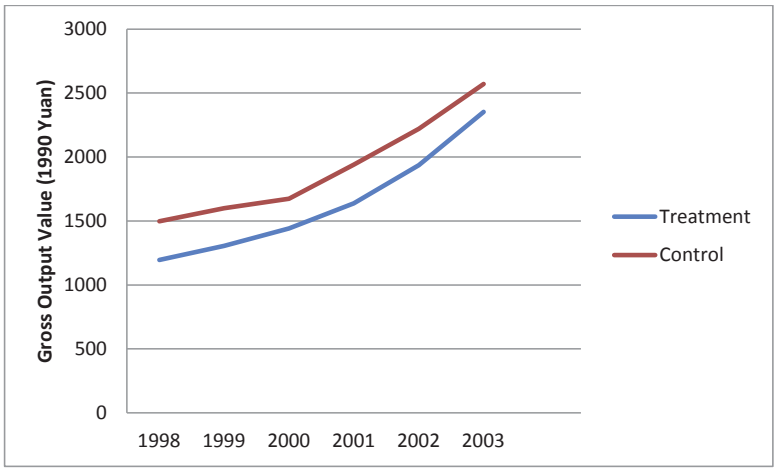


Figure 3.7: Number of Employed persons in TVEs (Township and village Enterprises) in Rural Area

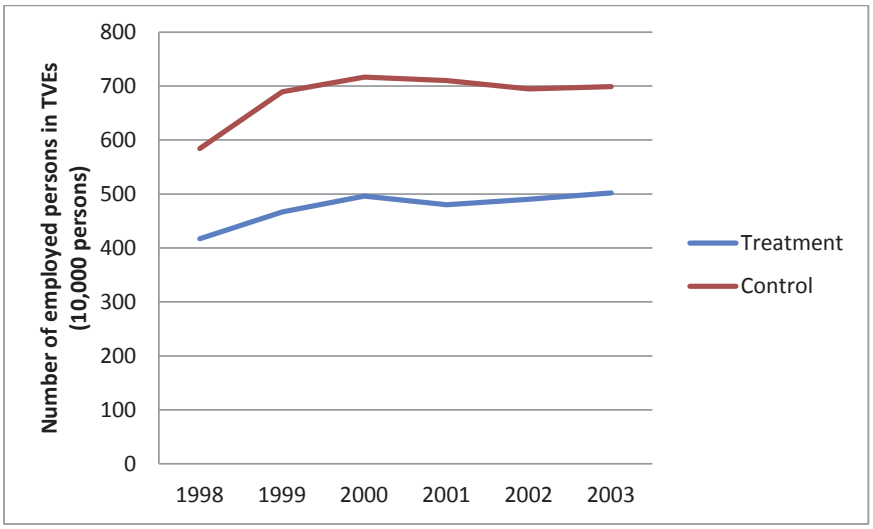


Figure 3.8: Number of State-Owned and State-Holding Enterprises

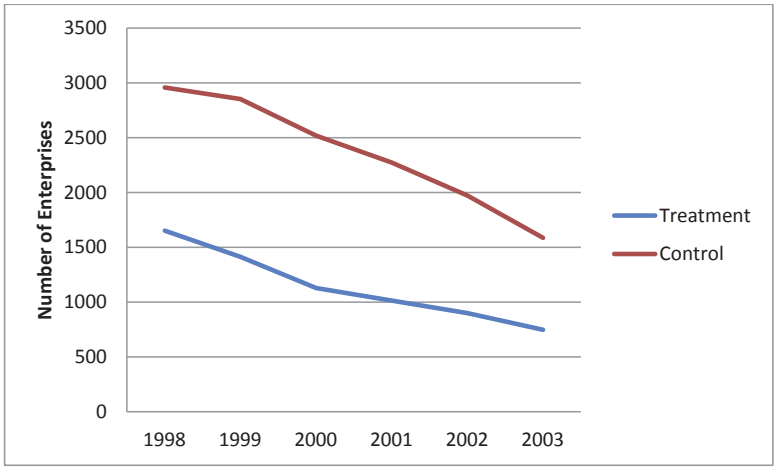


Figure 3.9: Gross Output Values of State-Owned and State-Holding Enterprises

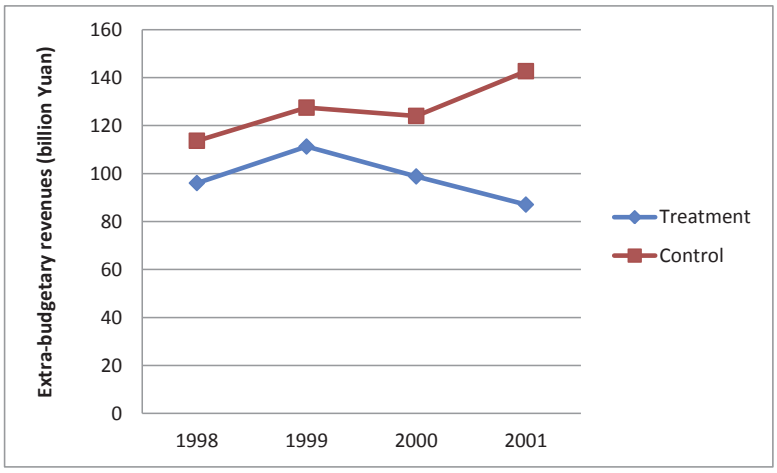


Figure 3.10: Number of Collective-Owned Enterprises

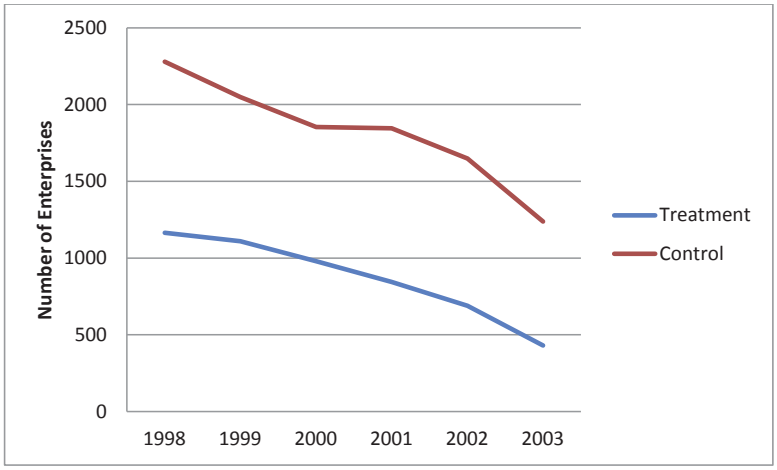


Figure 3.11: Gross Output Value of Collective-Owned Enterprises

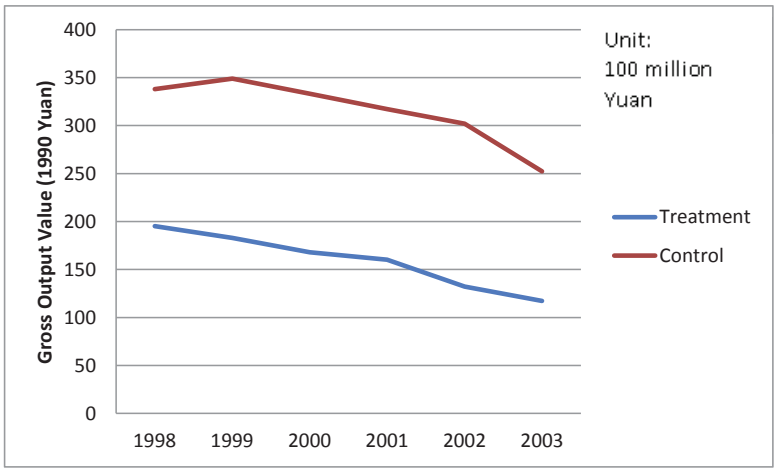


Figure 3.12: Number of Sharing-Holding Corporation Ltd.

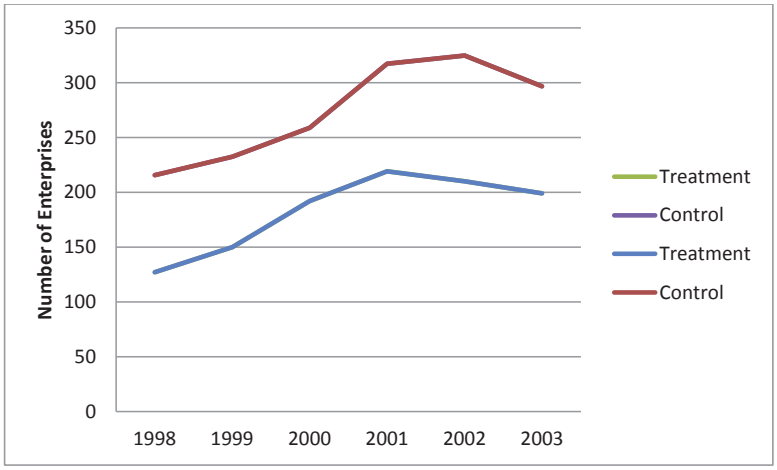


Figure 3.13: Gross Output Value of Sharing-Holding Corporation Ltd.

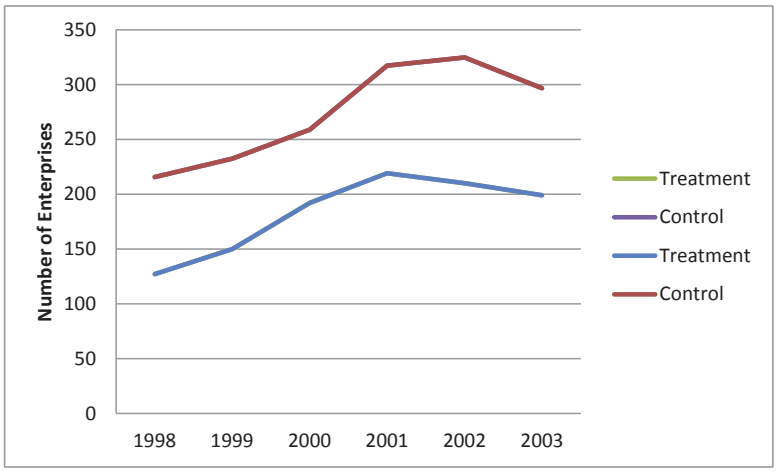


Table 3.1: Summary Statistics of Treatment and Control Groups

	Treatment Group		Control Group		Diff
	Obs	Mean	Obs	Mean	
	(1)	(2)	(3)	(4)	(5)
Panel A. Individual Characteristics					
Male	1461	.510	8732	.519	-.009
		(.0131)		(.0053)	(.0141)
Age	1461	28.70	8730	29.11	-.400
		(.488)		(.196)	(.5193)
Married	1461	.495	8732	.505	-.010
		(.0131)		(.0054)	(0.0141)
Low Education	1293	.936	7988	.911	.025**
		(.0068)		(.0032)	(.0086)
Female	640	.975	3874	.942	.033**
		(.0062)		(.0038)	(.0098)
Male	653	.897	4114	.882	.015
		(.0119)		(.0050)	(.0138)
Panel B. Household Characteristics					
Household Size	330	4.56	1950	4.52	.04
		(.074)		(.029)	(.078)
Regular	330	4.36	1950	4.34	.02
		(.068)		(.029)	(.075)
Out-migrants	330	.179	1950	.155	.023
		(.0251)		(.0116)	(.0299)
Mountain Area	330	.148	1952	.178	-.030
		(.020)		(.0087)	(.0226)
Land Cultivated(Mu)	330	5.14	1952	5.41	-.27
		(.166)		(.089)	(.227)
Land Leased Out(Mu)	330	.030	1952	.024	.006
		(.018)		(.0124)	(.0310)

Note: Standard errors are reported in parenthesis. Summary statistics of education level only takes into account individuals 7 years or older. The low level of education is defined as completing Junior High School (9th grade) or below. The unit of land area is Mu (=1/15 Hectare). Source: China Household Income Project (CHIP) 1995. *** Significant at 1% level ** Significant at 5% level * Significant at 10% level.

Table 3.2: Exogeneity of Reform

Independent Variable	Dependent Variable: Dummy for Reform					
	Total Payment	Fee	$\frac{\text{Total Income}}{\text{Total Income}}$	$\frac{\text{Fee}}{\text{Total Income}}$	$\frac{\text{Total Payment}}{\text{Net Income}}$	$\frac{\text{Fee}}{\text{Net Income}}$
	(1)	(2)	(3)	(4)	(5)	(6)
Coefficient	-.00002	-.00001	-.1510	-.0252	.0035	.0644
	(.00001)	(.00003)	(.1670)	(.3212)	(.0332)	(.0971)
F-test	2.54	0.45	0.82	0.01	0.01	0.44
[p-value]	[0.1114]	[0.5031]	[0.3657]	[0.9375]	[0.9164]	[0.5073]

Note: Standard errors are reported in parentheses. The sample includes 2,282 rural households. Total payment refers to the summation of all kinds of taxes and fees at the household level. The detailed information of constructing the measures can be found in Appendix. Source: China Household Income Project (CHIP) 1995.

Table 3.3: Change of Tax Payment (Household Level)

	Agricultural Tax	Fee	Total Payment			Total Payment/Total Income (%)			Total Payment/Disposable Income (%)		
	(Per Land Area)	(Per Capita)	All	$r < 0.61$	$r \geq 0.61$	All	$r < 0.61$	$r \geq 0.61$	All	$r < 0.61$	$r \geq 0.61$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Treat×Post	36.88***	-15.03***	104.4***	-35.91	256.0**	0.745**	-0.317	2.275***	2.875**	-1.401	4.904***
	(2.933)	(2.149)	(36.04)	(39.34)	(103.4)	(0.309)	(0.337)	(0.783)	(1.146)	(1.287)	(1.754)
Observations	4,201	4,475	4,478	535	3,943	4,477	534	3,943	4,470	533	3,937
R-squared	0.034	0.076	0.077	0.093	0.043	0.067	0.063	0.058	0.060	0.041	0.044
Mean (Treatment)	60.68	24.48	407.09	344.06	415.22	3.48	3.59	3.46	6.99	6.52	7.05

Note: Standard Errors are in the parenthesis. r = land area leased by the household/household size. The monetary amount has been deflated to 2002 Yuan by Rural Consumer Price Index. Total payment refers to the summation of all kinds of taxes and fees at the household level. Appendix details the construction of the measure total income. Disposable income refers to the household annual total income minus the tax payment and production expenses. This measure is directly reported in the data. Controlled household characteristics include land area, household size, share of male, average age of male/female, average years of education of male/female, average educational achievement of male/female, marriage status, whether the household head is female. Source: China Household Income Project (CHIP) 1995 and 2002. *** Significant at 1% level ** Significant at 5% level * Significant at 10% level.

Table 3.4: Treatment Effects on Household Sector-Specific Participation Rate

	Labor		Agricultural(Only)		Both		Nonagricultural(Only)		Agricultural(General)		Nonagricultural(General)	
	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Treat×Post	-0.0469	-0.0073	-0.0504	-0.128***	-0.0177	0.127***	0.0212	0.0063	-0.0681	-0.0010	0.00348	0.134***
	(0.0330)	(0.0062)	(0.126)	(0.0440)	(0.130)	(0.0440)	(0.0310)	(0.0042)	(0.0451)	(0.0075)	(0.128)	(0.0440)
Observations	535	3,931	535	3,931	535	3,931	535	3,931	535	3,931	535	3,931
R-squared	0.087	0.011	0.134	0.074	0.115	0.077	0.078	0.006	0.074	0.010	0.128	0.077
Mean (Treatment)	0.999	0.999	0.333	0.398	0.653	0.600	0.014	0.002	0.986	0.998	0.667	0.602

Note: Standard Errors are in the parenthesis. r = land area leased by the household/household size. Household working days are calculated by summing up working days of all household members between age 16 and 60. Participation rate is defined as the proportion of households that report positive working days in corresponding sectors. Household characteristics include land area, household size, household nonlabor income, share of male, average age of male/female, average years of education of male/female, average educational achievement of male/female, marriage status, a dummy variable that the household head is female, a dummy variable whether the household is in the mountain area and a dummy that the village has a school. Source: China Household Income Project (CHIP) 1995 and 2002. *** Significant at 1% level ** Significant at 5% * Significant at 10% level.

Table 3.5: Treatment Effects on Household Sector-Specific Conditional Working Days

	Labor		Agricultural(Only)		Total		Both Agricultural		Nonagricultural	
	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Treat×Post	-50.68*	258.6***	-35.01	-89.51**	-23.46	347.3***	-28.41	110.5	4.948	236.8***
	(27.52)	(83.89)	(32.29)	(43.71)	(36.96)	(99.02)	(31.10)	(82.21)	(23.31)	(64.31)
Observations	527	3,925	186	1,680	334	2,237	334	2,237	334	2,237
R-squared	0.177	0.176	0.291	0.123	0.297	0.179	0.251	0.099	0.262	0.126
Mean (Treatment)	650.153	607.143	353.875	438.541	794.851	719.493	453.170	461.561	341.680	257.931

Note: Standard Errors are in the parenthesis. r = land area leased by the household/household size. Household working days are calculated by summing up working days of all household members between age 16 and 60. Participation rate is defined as the proportion of households that report positive working days in corresponding sectors. Household characteristics include land area, household size, household nonlabor income, share of male, average age of male/female, average years of education of male/female, average educational achievement of male/female, marriage status, a dummy variable that the household head is female, a dummy variable whether the household is in the mountain area and a dummy that the village has a school. Source: China Household Income Project (CHIP) 1995 and 2002. *** Significant at 1% level ** Significant at 5% * Significant at 10% level.

Table 3.6: Self-Employment and Wage Earning Activities

	Self+Wage		Self(Only		Both)		Wage(only)	
	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat×Post	0.0138	0.138***	0.0488	-0.0555*	-0.0435*	0.0515***	0.0085	0.142***
	(0.127)	(0.0456)	(0.0905)	(0.0306)	(0.0226)	(0.0173)	(0.121)	(0.0432)
Observations	535	3,943	535	3,943	535	3,943	535	3,943
R-squared	0.087	0.115	0.052	0.023	0.041	0.022	0.102	0.066
Mean (Treatment)	0.569	0.482	0.167	0.120	0.009	0.050	0.393	0.312

Note: Standard Errors are in the parenthesis. r = land area leased by the household/household size. Household working days are calculated by summing up working days of all household members between age 16 and 60. Participation rate is defined as the proportion of households that report positive working days in corresponding sectors. Household characteristics include land area, household size, household nonlabor income, share of male, average age of male/female, average years of education of male/female, average educational achievement of male/female, marriage status, a dummy variable that the household head is female, a dummy variable whether the household is in the mountain area and a dummy that the village has a school. Source: Chinese Household Income Project (CHIP) 1995 and 2002. *** Significant at 1% level ** Significant at 5% * Significant at 10% level.

Table 3.7: Heterogeneous Treatment Effects according to Risk in Agricultural Production I

	Labor						Agricultural(Only)					
	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Imputed												
Treat×Post×Risk	-0.0335	-0.00841					-0.00149	-0.119***				
	(0.0370)	(0.00723)					(0.110)	(0.0375)				
Treat×Post	-0.0163	-0.00137					-0.0485	-0.0238				
	(0.0278)	(0.00516)					(0.0827)	(0.0268)				
Self-reported												
Treat×Post×Disaster			-0.0149	-0.00473					-0.00597	-0.103**		
			(0.0336)	(0.00764)					(0.106)	(0.0396)		
Treat×Post			-0.0328	-0.00368					-0.0985	-0.0350		
			(0.0236)	(0.00594)					(0.0745)	(0.0308)		
Rain Fall												
Treat×Post×STD					-0.00953	0.0192**					-0.0107	-0.103***
					(0.0159)	(0.00878)					(0.0925)	(0.0905)
Treat×Post					-0.0772	-0.00944*					-0.0474	-0.0578*
					(0.0732)	(0.00479)					(0.336)	(0.0300)
No. of County	40	40	40	40	16	16	40	40	40	40	16	16
No. Household	444	3,923	535	3,931	186	1,789	444	3,923	535	3,931	186	1,789
R-squared	0.157	0.031	0.149	0.031	0.174	0.085	0.205	0.290	0.191	0.292	0.374	0.320
Mean(treatment)	0.994	0.999	0.999	0.999	0.999	0.999	0.308	0.390	0.333	0.398	0.333	0.398

Table 3.8: Heterogeneous Treatment Effects according to Risk in Agricultural Production II

	Labor						Agricultural(Only)					
	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Imputed												
Treat×Post×Risk	0.0195*	0.124***					-0.0125	-0.0137				
	(0.0114)	(0.0377)					(0.0406)	(0.01334)				
Treat×Post	0.00904	0.00717					0.0232	0.0153				
	(0.00854)	(0.0269)					(0.0705)	(0.01206)				
Self-reported												
Treat×Post×Disaster			-0.00284	0.121***					-0.00609	-0.0229*		
			(0.0110)	(0.0398)					(0.0409)	(0.01564)		
Treat×Post			0.00941	0.00747					0.0563	0.0238*		
			(0.00772)	(0.0310)					(0.07548)	(0.01423)		
Rain Fall												
Treat×Post×STD					-0.00803	0.140***					0.00916	-0.0181***
					(0.0945)	(0.0857)					(0.00890)	(0.00308)
Treat×Post					0.0216	-0.00621					-0.00824	0.0544
					(0.344)	(0.0279)					(0.00788)	(0.0901)
County No	40	40	40	40	16	16	40	40	40	40	16	16
Household No.	444	3,923	535	3,931	186	1,789	444	3,923	535	3,931	186	1,789
R-squared	0.208	0.289	0.192	0.291	0.355	0.326	0.081	0.020	0.063	0.021	0.255	0.029
Mean(treatment)	0.654	0.603	0.653	0.600	0.653	0.600	0.031	0.006	0.653	0.600	0.653	0.600

Note: Standard Errors are in the parenthesis. Household working days are calculated by summing up working days of all household members between age 16 and 60. Participation rate is defined as the proportion of households that report positive working days in corresponding sectors. Imputed disaster is a dummy variable indicating that households agricultural income is lower than expected agricultural output in a normal year. Self-reported disaster status is the number of natural disasters households suffered from during the past five years. Rainfall data is recovered from provincial statistics year book at the county level. All the regressions control for the following household characteristics: land area, household size, household nonlabor income, share of male, average age of male/female, average years of education of male/female, average educational achievement of male/female, marriage status, a dummy variable that the household head is female, a dummy variable the household is in the mountain area and a dummy that the village has a school. Source: Chinese Household Income Project (CHIP) 1995 and 2002. *** Significant at 1% level ** Significant at 5% * Significant at 10% level.

Table 3.9: Treatment Effects on Savings

	Amount(2002 Yuan)						Percentaeg of Total Income(%)					
	Save 1		Save 2		Save 3		Save 1		Save 2		Save 3	
	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$	$r < 0.61$	$r \geq 0.61$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Treat×Post	-483.1	2,116***	-620.3	2,170***	2,805	3,166**	-1.436	12.04***	-0.496	12.655***	-8.245	17.24
	(1,241)	(673.9)	(1,248)	(664.4)	(4,589)	(1,281)	(7.964)	(3.810)	(7.868)	(3.753)	(27.04)	(8.519)
Observation	534	3,943	534	3,943	534	3,943	534	3,943	534	3,943	534	3,943
R-squared	0.166	0.101	0.171	0.118	0.363	0.432	0.149	0.045	0.143	0.048	0.350	0.367
Mean(treatment)	2980.585	5819.966	3167.557	6014.776	12675.950	13062.460	27.415	38.631	29.305	40.185	102.267	97.894

Note: Standard Errors are in the parenthesis. Household working days are calculated by summing up working days of all household members between age 16 and 60. Participation rate is defined as the proportion of households that report positive working days in corresponding sectors. Imputed disaster is a dummy variable indicating that households agricultural income is lower than expected agricultural output in a normal year. Self-reported disaster status is the number of natural disasters households suffered from during the past five years. Rainfall data is recovered from provincial statistics year book at the county level. All the regressions control for the following household characteristics: land area, household size, household nonlabor income, share of male, average age of male/female, average years of education of male/female, average educational achievement of male/female, marriage status, a dummy variable that the household head is female, a dummy variable the household is in the mountain area and a dummy that the village has a school. Source: Chinese Household Income Project (CHIP) 1995 and 2002. *** Significant at 1% level ** Significant at 5% * Significant at 10% level.

Table 3.10: Change of Per Capita Tax Payment along Ratio between Land Area and Household Size

	$r < 0.61$	$0.61 \leq r < 1$	$1 \leq r < 1.35$	$1.35 \leq r < 2$	$2 \leq r$	$r \leq 0.25$	$0.25 \leq r < 0.61$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treat×Post	23.03*	12.28	19.04**	31.53***	46.91***	-31.72	-17.69
	(13.24)	(8.490)	(7.392)	(5.460)	(12.18)	(26.23)	(10.94)
Observations	535	733	923	1100	1184	320	215
R-squared	0.084	0.056	0.044	0.052	0.117	0.062	0.214
Mean (Treatment)	75.4	72.41	98.17	104.35	106.43	59.2	81.41

Note: Standard Errors are in the parenthesis. r = land area leased by the household/household size. Household working days are calculated by summing up working days of all household members between age 16 and 60. Participation rate is defined as the proportion of households that report positive working days in corresponding sectors. Household characteristics include land area, household size, household nonlabor income, share of male, average age of male/female, average years of education of male/female, average educational achievement of male/female, marriage status, a dummy variable that the household head is female, a dummy variable whether the household is in the mountain area and a dummy that the village has a school. Source: Chinese Household Income Project (CHIP) 1995 and 2002. *** Significant at 1% level ** Significant at 5% * Significant at 10% level.

Table 3.11: Natural Disaster and Treatment status

	No. of Natural Disasters (Past 5 Years) (1)	Percentage of Decrease (Conditional) (2)	Transfer (Conditional) (3)
Treat	.017	-3.21	29.86
	(.0646)	(2.032)	(50.667)
F-statistics	0.07	2.50	0.35
[p-value]	0.79	0.11	0.56

Note: Standard Errors are in the parenthesis. r = land area leased by the household/household size. Household working days are calculated by summing up working days of all household members between age 16 and 60. Participation rate is defined as the proportion of households that report positive working days in corresponding sectors. Household characteristics include land area, household size, household nonlabor income, share of male, average age of male/female, average years of education of male/female, average educational achievement of male/female, marriage status, a dummy variable that the household head is female, a dummy variable whether the household is in the mountain area and a dummy that the village has a school. Source: Chinese Household Income Project (CHIP) 1995 and 2002. *** Significant at 1% level ** Significant at 5% * Significant at 10% level.