Three Essays on Household Consumption, Labor Supply, and Self-Insurance

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Economics)
in the University of Michigan
2018

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I owe particular thanks to my advisors, Frank Stafford, Dmitriy Stolyarov, Melvin Stephens, Charles Brown and Natasha Pilkauskas, for their knowledge and patience. I am also thankful for invaluable comments from seminar participants at the University of Michigan.

I dedicate this dissertation to my husband, Yonghao An, who has always been supportive of my work and encouraged me to finish my dissertation.

I am also blessed to have my son, Jiyao An, and daughter, Xin An by my side during this process. Thanks for keeping me busy and happy, which made this long journey much easier for me.

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ABSTRACT

This dissertation examines the insurance mechanism within the family and also in the extended family across different generations. The three essays contribute to the understanding of how family members respond to adverse income changes and avoid sharp fluctuations in consumption.

The first chapter links the added worker effect to the composition of household consumption. Committed consumption, such as housing expenses and vehicle installments, is costly to adjust. Therefore, the household is eager to maintain commitments, especially when an income fluctuation is modest or temporary. This forces a family member to supply additional market labor to avoid a sharp reduction in the flexible portion of consumption. The empirical evidence discovered in this chapter confirms that consumption commitments amplify the spousal labor supply response when the head of the family experiences a negative income change. When a household allocates more resources to infrequently adjusted goods prior to the shock, the wife is more likely to become a new entrant to the labor force and also to work more. This chapter also finds that overall responses from wives who were formerly out of labor market are more significant than those from wives already employed before the heads' income cuts.

The second chapter finds that adult children who received bigger negative income shocks during the Great Recession were more likely to move to live closer to their parents. Using intergenerational time transfer data from the Panel Study of Income Dynamics, this chapter confirms that adult children did use spatial closeness to facilitate time assistance from their parents, benefiting from risk sharing in the extended family. A two-generation model is used to examine the implication of time transfer. It shows how the possibility of time transfer affects the labor supply and welfare of adult children, and compares its impact with other forms of intergenerational transfers, such as financial transfers and coresidence.

The third chapter utilizes short-run housing wealth changes during the recent housing bust to identify the effect of parental wealth on post-secondary educational decisions. Estimation results show that family wealth hardly affected young adults' college enrollment or early dropout rate. However, in the face of reduced financial support from parents, college students significantly increased the amount of debt taken on under their own names and also chose to work more hours while in college.

CHAPTER 1

Consumption Commitments and the Added Worker Effect

1.1 Introduction

Many households allocate a considerable portion of their budgets to goods that involve adjustment costs and thus are not easily adjustable. Homeowners need to pay a substantial amount in closing fees and other moving costs to move away from owned property and be freed from the commitment of monthly mortgage payments. Even renters have to pay penalties if they want to break a rental lease earlier than previously agreed. In addition to housing expenditures, consumption of durable goods such as vehicles and furniture may also be costly to adjust when any household member experiences income fluctuations. These goods are categorized as "consumption commitments" in previous literature. Utilizing the Panel Study of Income Dynamics (PSID) data, I show that at least one third of an average household's consumption expenditures fall into this category.

This paper incorporates consumption commitments into the analysis of the added worker effect (AWE) in the short run. To the best of my knowledge, this is the first paper measuring the linkage between these two. It mainly argues that for married couples and co-residential partners, the presence of committed consumption affects the labor supply response of the secondary earner ("wife"), when the primary earner ("head") receives a negative income shock. There is a growing literature studying the added worker effect, particularly in the context of the most recent financial crisis and economic recession. Most of these studies focus on spousal responses to unexpected unemployment of the head of the family in terms of labor market participation and work time, without taking into account the specific consumption composition of the family (Ayhan, 2015; Giannakopoulos, 2015). One of the main contributions of this paper to the existing literature is that it documents a larger income elasticity of the spousal labor supply if the family devotes a higher share of family income to inflexible consumption goods prior to the head's unemployment shock. When the head of the family experiences a temporary or moderate income cut, the family has a strong motivation to maintain previously committed expenditures to avoid a costly adjustment. In this case, greater

consumption commitments leave the family with fewer opportunities to engage in intratemporal substitution of leisure for other goods. The wife is motivated to provide more market labor to avoid a substantial reduction in flexible consumption goods.

This paper also has several important implications for labor and macroeconomics. First, this paper provides further insights to within-family insurance and the consumption-smoothing mechanism. Most previous research work on intra-household risk sharing focuses on the role of family labor supply in smoothing consumption around the period of an income loss. Blundell et al. (2016) claim that joint labor supply at the household level helps to smooth consumption and is estimated to be the most important channel of insurance against idiosyncratic income shocks. This paper brings in a new perspective in relating the family labor supply to the consumption-smoothing mechanism. In my paper, consumption smoothness can be attributed to the fact that a considerable portion of household expenditures is fixed over small or moderate income shocks. The inability to adjust committed consumption forces family members to supply additional market labor, absorbing the impact of income fluctuations. Therefore, a household's effort to maintain the commitments leads to better self-insurance and more consumption smoothness. I can further make a prediction that a household's consumption exhibits more smoothness in the short run, since the adjustment cost would be lower in the long term.[1] The empirical evidence discovered in this paper is also consistent with Blundell et al. (2008), who find that transitory income shocks are better insured than permanent ones.[2] Permanent shocks are more likely to result in significant changes in lifetime wealth, causing an household to abandon previously committed expenditures in an optimal manner. In contrast, with transitory shocks, the household tends to maintain the commitments, and the wife of the family is motivated to work more to compensate for temporary income losses.

Second, this paper helps to understand the role of wealth status and borrowing constraints in the family labor response to an income shock. My paper supplements the literature by showing that conditional on the same share of family income devoted to committed goods prior to the head's unemployment shock, accumulated wealth significantly affects the added worker effect upon the head's income shock. Families with low consumption commitments and high levels of liquid assets are more likely to substitute leisure for labor when the wage of any family member is temporarily low. In contrast, voluntary unemployment would not be an attractive choice for less wealthy households with high committed consumption and low levels of liquid assets. While family wealth can help to mitigate the impact of income fluctuations, non-contingent borrowing is usually constrained. Binding borrowing constraints can substantially amplify the labor responses to income shocks, asymmetrically affecting those with downward wage changes.

[1] See Vereshchagina (2014).

[2] Blundell et al. (2008) find that the discrepancy between consumption inequality and income inequality in recent decades can be characterized by the change in the degree of persistence of the underlying income shocks.

Third, this paper sheds lights on the influence of consumption commitments on the labor market at the macroeconomic level. The difficulty in adjusting housing consumption during the recession gave wives from families with heads experiencing unemployment strong motivations to find jobs and work more. An outward shift in the labor supply via the added worker effect induced by an adverse economic condition, combined with an inward shift in demand, can have important macroeconomic implications for aggregate unemployment.

To demonstrate the implication of commitments on household behavior, especially the added worker effect, this paper sets up an intra-household model and formulates three important qualitative hypotheses accordingly. The key difference between my model presented in this paper from those in the previous literature is that the representative agent consumes two types of goods, one of which requires adjustment costs. The first two hypotheses are related to the importance of consumption commitments. The presence of commitments creates an inaction area where the household doesn't adjust committed consumption upon the head's small or moderate income shock. The third hypothesis proposes a positive association between the precommitted share and spousal labor supply elasticity. Intuitively, consumption commitments make the income elasticity of the spousal labor supply larger, conditional on the same shock to the primary earner.

After proposing qualitative hypotheses, I utilize the PSID data to test whether each of them is consistent with the empirical evidence. The quantitative effects of consumption commitments on household behavior, particularly the added worker effect, are appropriately measured. In Section 1.4, estimation results confirm that spousal labor supply helps to absorb income shocks, and is amplified by a higher income share devoted to commitments. When heads of the family experience adverse income shocks, wives from families with more resources allocated to infrequently adjusted goods are more likely to enter the labor market and provide more hours regardless of the previous employment status. In addition, the "added worker effect" on the extensive margin is more noticeable than the "added hour effect" on the intensive margin. I also examine several other important margins related to household behavior in Section 1.6, and study how consumption commitments could possibly affect these decisions. For instance, inflexible consumption makes the impact of a moderate income shock concentrated on adjustable goods, and makes a household save more even when no income shock is present.

This paper is related to several strands of literature. First, it contributes to the studies on the economic significance of consumption commitments. The most closely related paper is Dau-Schmidt (1992). He examines the effects of consumption commitments and liquidity constraints on workers' labor supply responses. He concludes that both of these factors imply a smaller elasticity of labor supply, since both restrict a worker's opportunity to accommodate an unexpected wage change. However, his analysis is limited to the head's labor supply only. Chetty and Szeidl (2007) show that commitments affect risk preferences by amplifying risk aversion to moderate-

stake shocks and creating a motive to take large-payoff gambles. Chetty and Szeidl (2016) distinguish the consumption-commitment model from the habit-formation model and conclude that the commitment model is more consistent with the empirical evidence associated with excess consumption sensitivity and smoothness which vanish for large shocks. Postlewaite et al. (2008) prove that an optimal employment contract can incorporate the possibility of unemployment when consumers have consumption commitments.

The second strand of literature is on the added worker effect. Stephens (2002) analyzes wives' responses before and after their husbands' job losses to examine life-cycle labor supply adjustments and finds small pre-displacement and large, persistent post-displacement effects. Starr (2014) shows that employment rate of women whose husbands were non-employed rose significantly during the recession from 2007 to 2009, confirming that women did take on additional bread-winning responsibilities to make up for income losses. Other related papers take one further step to examine intra-household insurance through the family labor supply. Attanasio et al. (2005) explore the role of female labor supply as an insurance mechanism against idiosyncratic earnings risks within the family and find the added worker effect is greater when the household's ability to borrow is limited. Similarly, Ortigueira and Siassi (2013) find that intra-family risk sharing has its largest impact among wealth-poor households. While the wealth-rich utilize savings to smooth consumption during unemployment spells, wealth-poor households rely on spousal labor supply. Shore (2010) argues that these risk-sharing benefits of marriage are countercyclical. Husbands' and wives' income changes are more positively correlated during economic expansions, while they are not during bad times. Blundell et al. (2015) and Blundell et al. (2016) examine the insurance from various sources and emphasize the important role played by family labor supply in self-insuring household consumption against wage shocks. Gorbachev (2016) also concludes that a married woman's attachment to the labor market affects her family's ability to smooth unexpected income fluctuations.

Third, my paper complements the literature studying the impact of credit constraints or wealth status on household behavior. Engelhardt (1996) examines the effect of down payment constraints on consumption behavior and finds that households experience higher growth in real consumption across periods of home purchase than across periods without a purchase. Del Boca and Lusardi (2003) utilize changes in the mortgage market to study the effect of financial markets on the labor market. They find a statistically significant positive impact of having a mortgage on the probability of married women working. Card et al. (2007) find the amount of cash on hand affects the search intensity of the secondary earner when the primary earner experiences unemployment. Krueger and Perri (2011) show that labor income shocks are associated with modest consumption changes and more substantial wealth changes. The empirical evidence suggests that moderate income changes can be well insured through simple borrowing and saving. Kaplan and Violante (2014) find that

"wealthy hand-to-mouth" households, who hold little or no liquid wealth, display high propensities to consume out of additional transitory income, in sharp contrast to the non-hand-to-mouth households. Rossi and Trucchi (2016) argue that binding liquidity constraints induce workers to provide more labor instead of reducing consumption, and find empirical evidence from Italian survey data. Herkenhoff et al. (2016) examine how consumer credit access affects displaced workers and show that a credit limit increase allows individuals to spend a longer period finding a job. My paper complements this study by examining the influence of borrowing constraints on spousal labor supply.

Finally, this paper relates to studies linking household consumption to earnings dynamics (Stephens, 2001; Kaplan and Violante, 2010; Meghir and Pistaferri, 2011). The remainder of the paper proceeds as follows. Section 1.2 uses the PSID data to show the composition of households' consumption. By categorizing consumption expenditures into flexible goods and inflexible ones, I find that at least one third of an average household's expenditures can be considered commitments. Section 1.3 lays out a representative agent model to emphasize the implications of having consumption commitments for household behavior, particularly the spousal labor supply response. Section 1.4 performs econometric estimations to test the hypotheses formed in Section 1.3. Section 1.5 confirms the robustness of the impact of precommitted consumption on the added worker effect and added hour effect. Section 1.6 examines the influence on other key household behavior variables with the presence of consumption commitments. Section 1.7 further discusses some issues and estimation problems that cannot be addressed in this paper. Section 1.8 concludes.

1.2 Consumption Composition

In this section, I show the adjustment patterns of several important types of consumption, and then categorize household expenditures. The most relevant data used in this section is PSID consumption expenditure data, collected biennially from 1999 to 2007.[3] It contains expenditure information about food, housing, transportation, education, childcare and health care at the family level. Some categories are further disaggregated into several components.[4] The PSID expenditure data since 2005 include several additional categories not available in prior years.[5] To use as many obser-

[3]PSID is the longest running national household panel survey in the United States. The PSID survey was conducted annually from 1968 to 1997, and since 1997, PSID data has been collected biennially. The most recent round of surveys was published in 2015.

[4]Housing expenditure is decomposed into mortgage, rent, property tax, home insurance, and utility. Transportation expenditure is generated by combining vehicle loan, lease, and down payments, auto insurance, additional vehicle expenditures, repairs and maintenance, gasoline, parking, bus and train fares, taxicabs and other transportation. Health care contains expenditures for hospital and nursing home, doctor, prescription drugs and health insurance.

[5]These additional categories of consumption are household repairs, household furnishing, clothing, trips and other recreation expenditures.

vations as possible, only categories which show up in all survey years from 1999 are used for calculations below.

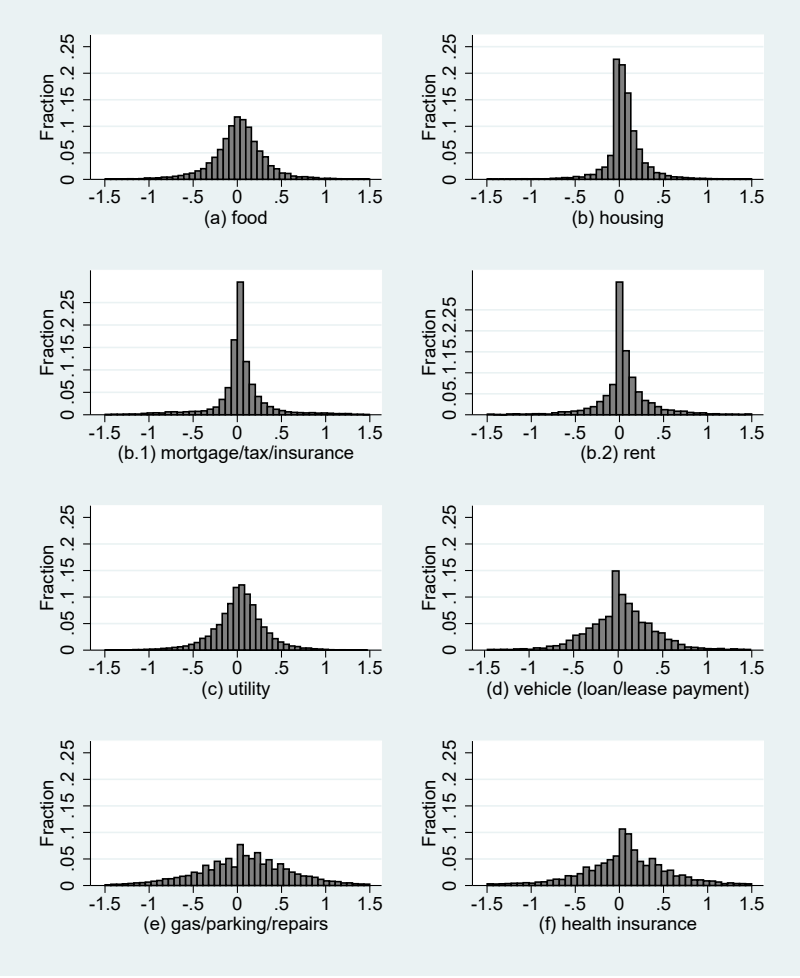
Consumption expenditures are broadly categorized into two types, according to how flexibly they can be adjusted. Committed goods are those that involve adjustment costs when making changes and that are therefore infrequently transacted. The most common committed consumption is housing expenditure for homeowners. If households do not move, they need to make monthly mortgage payments, and pay for home insurance and taxes as previously scheduled. All of these expenses can hardly be postponed or manipulated unless households pay the required adjustment costs to move. There are many other types of consumption commitments besides housing expenditure. For example, vehicle loans and lease payments usually need to get paid as previously agreed, which leaves borrowers little room to renegotiate the amount and timing of make payments. In contrast to the committed goods, flexible ones are nearly free to adjust. The most common adjustable goods are food and utilities. Figure 1.1 shows the adjustment frequencies of several important consumption categories. All available observations in the consumption expenditure data from 1999 to 2007 are used for calculations. To account for the fact that the composition of the family unit could have changed during this period, Figure 1.2 exhibits the adjustment patterns based on consumption expenditures per household member. There is no substantially discernible discrepancy between theses two figures. All the distributions adjusted by the household size are relatively more dispersed than the unadjusted ones.

Each graph of Figure 1.1 and Figure 1.2 shows the distribution of annualized nominal growth of one particular category of consumption expenditures, calculated from the annualized log change in each type. It is obvious that housing expenditure is relatively infrequently adjusted, indicating commitment. Vehicle consumption, particularly car loan and lease payments, is also relatively infrequently adjusted. In sharp contrast, non-durable goods such as food and utilities are frequently changed over time. The most dispersed distribution in Figure 1.1 is for expenditures related to vehicle usage (Figure 1.1.e), such as gasoline, parking and maintenance.

Table 1.1 provides detailed information about family consumption composition, and categorizes it into commitments and non-commitments, depending on adjustment frequencies.[6] As in Chetty and Szeidl (2007), housing is defined as total expenditure on housing excluding utility. Other vehicle expenditure combines vehicle down payment and additional vehicle spending not included in vehicle purchase. Other transportation contains expenses related to bus and train fares, taxicabs or any other type of transportation. Health care includes expenditures for hospital and nursing home, doctor, and prescription drugs, excluding out-of-pocket health insurance. See Ap-

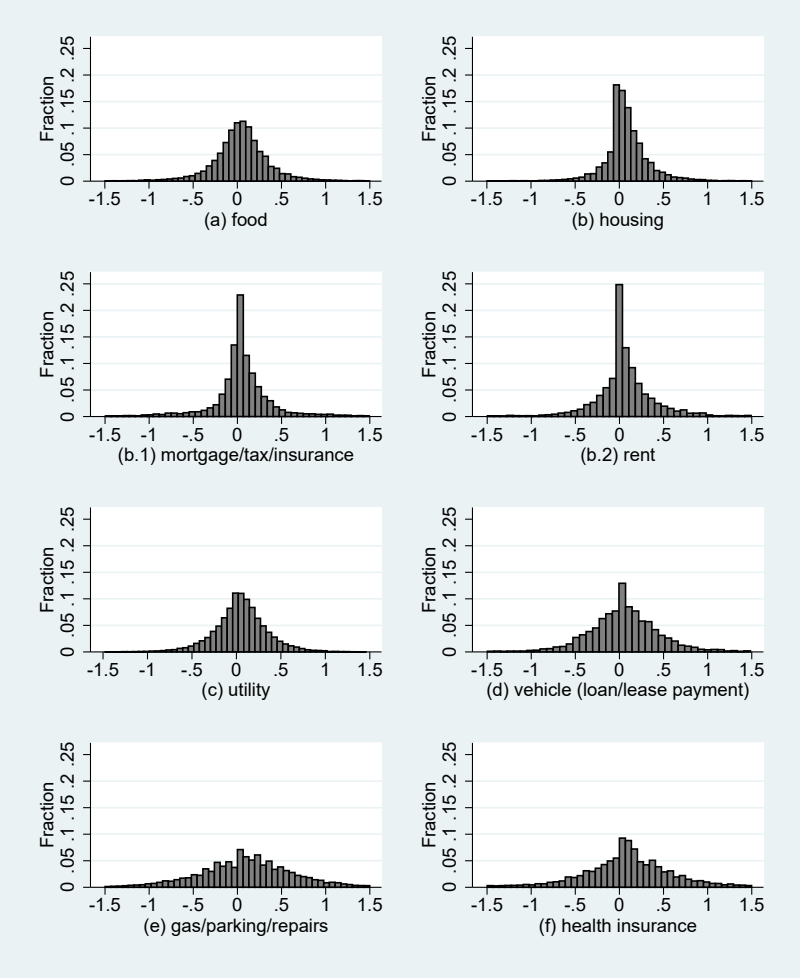
[6]The existing literature finds that PSID aligns closely with corresponding measures from the Consumer Expenditure Survey (CEX). Both distinct categories and total expenditures compare favorably between the two surveys (Skinner, 1987; Guo, 2010; Li and Charles, 2010; Creech, 2009; Andreski et al., 2014).

Figure 1.1: Consumption Adjustment Patterns



NOTE: These figures show the distributions of annualized nominal growth rates of various consumption categories, following the methodology described in Appendix A.1. PSID consumption expenditure data from 1999 to 2007 are used for calculations.

Figure 1.2: Consumption Adjustment Patterns (Per Household Member)



NOTE: These figures show the distributions of annualized nominal growth rates of various consumption categories adjusted by household size, following the methodology described in Appendix A.1. PSID consumption expenditure data from 1999 to 2007 are used for calculations.

pendix A.1 for more details about calculation methodology.

Table 1.1: Expenditure Shares and Adjustment Frequencies by Consumption Category

CONSUMPTION CATEGORY	SHARE OF TOTAL EXPENDITURES		FRAC. REDUCING CONSUMPTION	
	PSID	*CEX*	*PSID*	*CEX*
Housing (%)	27.9	22.2	21.9	8.7
Mortgage, tax and ins. (%)	15.9	-	36.8	-
Rent (%)	11.9	-	28.2	-
Health insurance (%)	3.9	3.0	39.1	32.9
Vehicle loan/lease (%)	4.4	14.7^{+}	42.0	10.8^{+}
Food (%)	23.7	18.1	44.6	42.8
Utility (%)	10.1	8.2	43.4	45.8
Vehicle insurance (%)	4.7		44.9	
Gas, parking and repairs (%)	10.1	-	43.6	-
Other vehicle expenditures (%)	5.8		45.6	
Other transportation (%)	1.0	-	43.8	-
Health care (excl. ins.) (%)	3.7	3.0	44.5	47.8
Miscellaneous (%)	4.3	-	45.2	-

NOTE: The first column shows expenditure shares for consumption categories in the PSID data, following the methodology described in the Appendix A.1. The third column reports the fraction of households adjusting consumption downward (negative annualized nominal growth rate). The fifth column reports the fraction of households reducing or increasing consumption by more than 10 percent (absolute value of annualized nominal growth rate more 10 percent). The second and fourth columns are taken from Chetty and Szeidl (2007) for comparison. Categories above the dotted line are classified as"commitments" by frequency of adjustment.

From the table, there are several categories which are adjusted relatively less frequently, compared with others. Lower adjustment frequencies indicate that these goods are comparatively more difficult to change, probably due to higher adjustment fees. Housing expenditures for both homeowners and renters are less likely to get reduced from year to year. The consumption of durable goods and services such as health insurance and vehicle loan or lease payments is also infrequently adjusted. In sharp contrast, consumption expenditures such as vehicle usage and health care (excluding health insurance) change enormously from period to period, indicating high flexibility.[7] I categorize the top three goods with the lowest fractions of downsizing consumption as commitments, and all others as non-commitments. The committed goods are housing, health insurance, and vehicle installments. On average, more than one third of a household's budget is composed of committed goods. This expenditure share of commitments is used for calibration in the following sections.[8]

[7]Consumption commitments may have fewer reporting errors than other consumption categories. This may artificially cause fewer movements in the commitment categories.

[8]Chetty and Szeidl (2007) use data from the Consumer Expenditure Survey (CEX) and find that more than 50 percent of an average household's budget is fixed over moderate income shocks.

1.3 The Implications of Consumption Commitments

Section 1.2 shows that a considerable portion of household consumption is inflexible. Committed consumption such as mortgage and rent payments can influence a household's risk preference as described in Chetty and Szeidl (2007)'s paper, and this paper emphasized that it is also possible to affect the added worker effect when the head of the family experiences a negative income shock. This section builds a partial equilibrium model with a one-time income shock to illustrate the mechanism of how consumption commitments affect spousal labor supply. Section 1.4 performs econometric estimations to test the hypotheses formed in Section 1.3.

1.3.1 Model Setup

In the model, a representative household lives for T periods, and consumes two goods: adjustable goods, such as food (c), and committed goods, mostly housing (k). It is costless to adjust the first type of goods, while the other requires an adjustment cost to change the committed amount of consumption. The adjustment cost is proportional to the amount of commitment, $\xi \cdot k$. The household's maximization problem is:

$$\max \quad E_0 \sum_{t=0}^{T} \beta^t u\left(c_t, k_t, h_t^s\right), \tag{1.1}$$

given the initial family wealth status in period zero. The utility function is strictly increasing in c and k, decreasing in h^s, strictly concave, and continuously differentiable. $u_{c,k} \geq 0$, $u_{c,h^s} \leq 0$, and $u_{k,h^s} \leq 0$. h^s is spousal work time. The multiplication of the discount factor (β) and gross interest rate ($1+r$) is 1. Thus, in the absence of unexpected shocks, the household wants to perfectly smooth its consumption. Assume the primary earner (head) of the family cannot choose hours worked, but the wife can. The head faces an income stream denoted by y_t^h, and the wife takes the wage rate w_t^s as given. The household can hold one liquid asset. Family wealth at the end of each period t is denoted as A_t. The evolution of family wealth is:

$$c_t + k_t + \xi \cdot k_{t-1} \mathbf{1}\{k_t \neq k_{t-1}\} + \frac{A_t}{1+r} = A_{t-1} + y_t^h + \omega_t^s h_t^s \quad \text{for } 0 \leq t \leq T. \tag{1.2}$$

The family wealth at the end of the last period is zero. In each period, when the head's income is revealed, the family decides whether to maintain the current level of committed consumption, or make any adjustment. *Proposition 1* shows that given a sufficiently large negative shock to y_t^h, the family will optimally choose to pay the adjustment fee and reduce the committed amount. Small shocks do not induce movements in committed consumption, and the negative income effect concentrates on the freely adjustable goods.

For illustration purposes, suppose that in period 0, the representative agent maximizes the utility function conditional on the expectation that the head's income stream is flat since period 0 ($y_t^h = y_0^h$ for $0 \leq t \leq T$). Therefore, without income shocks in any of the following periods, $c_t = c_0$, $k_t = k_0$, and $h_t = h_0$. Then suppose there is an income shock to the head of the family which only happens in period 1 when all uncertainties are resolved. After the shock is revealed, the household chooses a level of committed consumption k_1 to maximize its expected lifetime utility, given the initial wealth A_0 and prior commitment k_0. Two assumptions are used in this partial-equilibrium model to simplify the analysis. The first is that there is no borrowing constraint as long as the household can pay off its debt by the end of the last period. The second is that the household receives an income shock only in the first period, when it learns the entire income stream from period 1 to period T.

The optimal consumption and labor supply in period 1 are determined by the lifetime wealth and initial commitment k_0. When all income uncertainties are revealed in period 1, the optimal consumption path is flat, and so is the wife's labor supply:

$$k_t = k_1, c_t = c_1, \text{ and } h_t^s = h_1^s \quad \text{for } 1 \leq t \leq T.$$

When the head of the family receives a negative income shock in period 1, the decision to deviate from previously committed expenditure (k_0) is governed by the trade-off between consuming the optimal bundle of flexible and committed goods and the adjustment cost associated with committed consumption. The inflexibility to move amplifies the risk aversion and gives the wife a stronger incentive to work more to make up for the expanding share of committed spending.

Under the same assumptions as in Chetty and Szeidl (2007), I make the following proposition[9]:

Proposition 1 *For each positive k_0, there exists $\underline{y}_1$ and $\bar{y}_1$ such that:*
(I) when $\underline{y}_1 \leq y_1^h \leq \bar{y}_1$, there is no adjustment in the committed goods ($k_t = k_0$), and spousal labor supply increases as the head's realized income decreases;
(II) when $y_1 \leq \underline{y}_1$ or $y_1^h \geq \bar{y}_1$, there are adjustments in both types of goods, and labor supply increases as the head's realized income decreases;
(III) there exists a range where the wife from the family with realized head's income above the cutoff actually works more than that from the family with income below the cutoff.

When a household experiences a moderate-scale negative shock, it is not optimal to adjust the

[9]These assumptions include: (1) u is strictly increasing in c and k, strictly decreasing in h, strictly concave and twice differentiable; (2) $u_{c,k} \geq 0$, $u_{c,h} \leq 0$, and $u_{k,h} \leq 0$; (3) $lim_{c\to\infty} u_c = lim_{k\to\infty} u_k = 0$, and $lim_{c\to 0} u = inf_{c,k} u$; and (4) the CRRA over c is greater than the CRRA over k.

committed part of consumption expenditures. Thus the wife has a strong incentive to work to fund the committed consumption and prevent a costly adjustment. If the shock is sufficiently large, maintaining previously committed expenditure means an enormous adjustment in flexible goods. Then it is preferable for the agent to adjust consumption on both fronts. Otherwise, the drastically reduced flexible consumption and additional labor supplied lead to a substantial reduction in utility. It becomes optimal to cut back the committed consumption by paying the adjustment cost. Once the total spending is reduced, the wife has less motivation to work as hard as in the case in which the previous commitment is maintained. This implies a bigger income elasticity due to the inability to fully re-optimize consumption, particularly in the short run.[10] A similar conclusion can be made when a sharp rise in the head's income happens. Instead of just spending more on nondurable goods and working less, the household will eventually choose to expand the committed consumption, at the expense of paying the transaction cost to be able to do so. It is possible that given a large positive shock, the wife will actually work more than in the case where there is no deviation from the previous committed level of consumption.

A Special Case. Suppose the utility function is given as:

$$u(c,k,h^s) = \frac{c^{1-\sigma}}{1-\sigma} + \mu \cdot \frac{k^{1-\gamma}}{1-\gamma} - \delta \cdot \frac{(h^s)^{1+\eta}}{1+\eta}, \tag{1.3}$$

and the budget constraints are:

$$\begin{aligned} &c_t + k_t + \xi \cdot k_{t-1}\mathbf{1}\{k_t \neq k_{t-1}\} + \frac{A_t}{1+r} = A_{t-1} + y_t^h + w^s h_t^s \quad \text{for } 0 \leq t \leq T, \\ &A_{-1} \text{ and } k_{-1} \text{ are given, and } A_T = 0. \end{aligned} \tag{1.4}$$

The head's income stream is predetermined, and constant over time ($y_t^h = y_0^h$ for $0 \leq t \leq T$). The head's labor supply is fixed exogenously. The wife's wage rate is also known and constant over periods. Each family starts with initial wealth A_{-1} and ends with zero wealth at period T. Details of the solution to the household's maximization problem are given in Appendix A.2. Table 1.2 shows the parameters used in the model and also gives the main reasons for choosing those numbers. σ is 5 so that the elasticity of substitution of nonburnable consumption is 0.2. μ equals 0.38 to match the ratio of flexible goods to committed consumption ($c/k = 2$) shown in the previous section. η is set to the common value of Frisch elasticity of labor supply. δ is set to 3.24 so that on average

[10] Suppose the elasticities of spousal labor supply with respect to the head's income in period 1 are $\varepsilon^n_{h^s,y^h}$ (without commitments) and $\varepsilon^c_{h^s,y^h}$ (with commitments). I can decompose the elasticity of labor supply into:

$$\varepsilon^n_{h^s,y^h} = \varepsilon_{h^s,y^h|k} + \varepsilon_{h^s,k} \cdot \varepsilon_{k,y^h}.$$

At $y^h = \tilde{y}$ where $k^n(\tilde{y}) = k_0$. Then $\varepsilon^c_{h^s,y^h} - \varepsilon^n_{h^s,y^h} = -\varepsilon_{h^s,k} \cdot \varepsilon_{k,y^h}$. It is obvious that the income elasticity of spousal labor supply is amplified when a household has commitments.

the wife works 60 percent of the time of the head. The head's labor supply and initial income are both fixed and normalized to one. ξ is set to 1 so that on average the family spends 6 months of the head's income to adjust the committed part of consumption.

Table 1.2: Parameters Used in the Intra-Household Model

PARAMETERS	VALUES	REASONS
σ	5	elasticity of substitution equal to 0.2 for nondurable goods
γ	1	log utility for committed goods
μ	0.38	match the share of committed goods (1/3)
δ	3.24	match the average spousal working time (60% of the head's)
η	3	Frisch elasticity of labor supply equal to 1/3
A_{-1}	0.2	the amount of liquid assets equal to 2-3 months of the head's yearly income
β	0.96	annual interest rate 4%
ξ	1	the average adjustment cost equal to 6 months of the head's yearly income
w	1	no gender pay gap

Figure 1.3 compares two cases, one with no adjustment cost and the other with a positive cost to adjust the committed consumption. It confirms that the income elasticity of spousal labor supply is amplified in the case of having consumption commitments. Notably, the added worker effect concentrates on households with moderate income shocks. For small income cuts, families tend to maintain inflexible goods and work for a longer time. With substantial declines in earnings, rather than allocating more time to work to maintain commitments, families prefer to pay the adjustment cost and downgrade to a smaller house. There is an (S,s) band with no adjustment as shown in Figure 1.3.

1.3.2 Accounting for Responses on the Extensive Margin

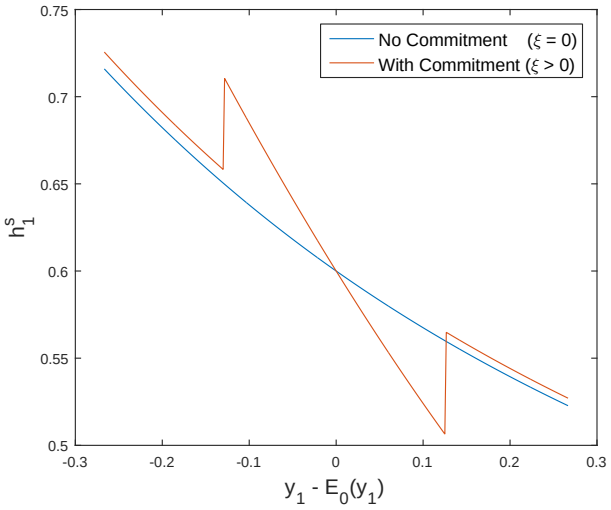
In the benchmark, there is no opportunity cost associated with the wife providing market work, except the foregone leisure. In real life, the secondary earner often faces a trade-off between working and staying at home doing housework and taking care of younger children. To take this incentive into account, I modify the model by adding the fixed monetary cost (F) attached to labor participation, and allowing the wife to voluntarily choose whether to participate.

Accordingly, the intertemporal budget constraint becomes:

$$\begin{aligned} c_t + k_t + \frac{A_t}{1+r} &= A_{t-1} + y_t^h + P_t(w^s h_t^s - F) \quad \text{for } 0 \le t \le T-1, \\ c_T + k_T &= A_{T-1} + y_T^h + P_T(w^s h_T^s - F), \end{aligned} \tag{1.5}$$

and the utility function remains the same as before. The benchmark shown in Subsection 1.3.1 can be treated as a special case with F equal to zero. In eqn.(1.5), P_t indicates whether the wife in

Figure 1.3: Consumption Commitments and Spousal Labor Supply Response

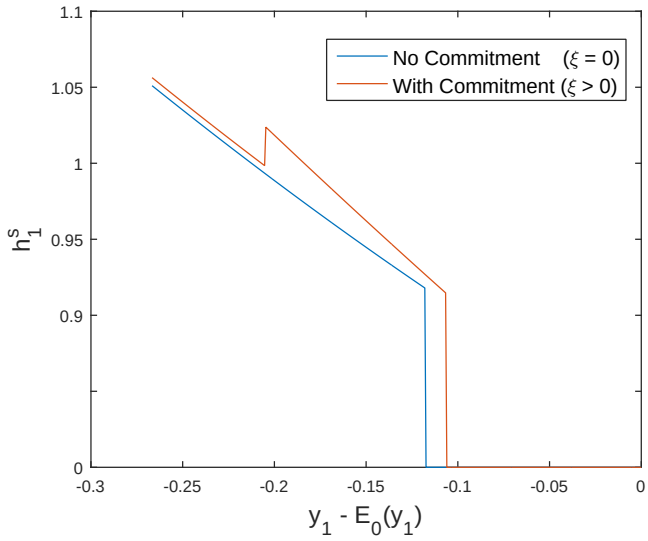


NOTE: See the model setup in Subsection 1.3.1 and parameter values in Table 1.2. The y-axis is the spousal labor supply relative to the head's (fixed at 1) in period 1 when the income shock is revealed. The x-axis is the deviation in the head's realized income in period 1 from the previous expectation.

period t optimally chooses to enter the labor force and work. When the wife indeed opts to work, the opportunity cost denoted by F is subtracted from the income earned in that period. Intuitively, when the opportunity cost of going to work is high (such as when a larger size of household needs to be taken care of), the wife would prefer to stay at home. However, when the head of the family experiences an income loss, the potential money brought in by the wife would be valued more. Having committed a larger share of family income to costly adjustable goods further motivates the wife to enter the labor force in this scenario. Details of the solution to the extended model with endogenous labor force participation are discussed in Appendix A.4.

Figure 1.4 shows the solution graphically in the absence of borrowing constraints. It compares the no-commitment case with the commitment case as in Subsection 1.3.1. For illustrative purposes, F is arbitrarily set to 0.75. It is obvious from the figure that the presence of consumption commitments increases the likelihood of the wife entering the labor force, conditional on the magnitude of the negative income shock. It also shows that conditional on entering employment status, commitments lead to working more hours. This figure confirms that spousal labor supply response is amplified by commitments, not only in terms of working hours (*added hour effect*), but also labor force participation (*added worker effect*). Therefore in Section 1.4, both intensive and extensive margins of spousal labor supply responses are examined.

Figure 1.4: Consumption Commitments and Spousal Labor Supply Response (With Labor Participation)



NOTE: See the model setup in Subsection 1.3.2 and parameter values in Table 1.2. The y-axis is the spousal labor supply relative to the head's (fixed at 1) in period 1 when the income shock is revealed. The x-axis is the deviation in the head's realized income in period 1 from the previous expectation.

1.3.3 Testing the Implications of Consumption Commitments

I show that commitments can have important implications on household behavior using a partial-equilibrium model. In this part, I focus on how to apply real-life data to the theoretical model. Several hypotheses are formed to test various impacts of having commitments on a household's decision making.

Hypothesis 1: *Consumption commitments lead to differential responses to small versus large income shocks. Bigger income shocks increase the chance of households adjusting committed consumption.*

In Section 1.2, I show that the major components of commitment expenditures are mortgages or rent, and vehicle loans or leases. It is relatively hard to observe whether a household changed car-related expenses in the data, but it is easy to find one indicator of whether a family adjusted its housing commitment. In each round of PSID surveys, participants were asked whether they had geographically moved since the last survey. When a household wants to change its mortgage or rent obligation, it almost certainly has to relocate to be able to do so. Although it is possible for mortgage takers to refinance and partially alleviate the burden of periodic bills, it becomes harder

to do so when the economic situation deteriorates.

As shown in Figure 1.3, because of the non-negligible adjustment cost of commitments, it is not optimal to change inflexible consumption such as mortgages and rent when moderate income variations occur. Therefore given temporary and small income changes, households prefer to resort to extra labor supply instead of paying adjustment expenses. For larger shocks, households are more likely to bear the adjustment expenses to avoid reducing flexible goods sharply. They will choose to fully re-optimize over both types of goods. In section 1.4, I utilize the event of an unemployment shock to the head of the family from the PSID spanning from 1968 to 1997, and test whether a bigger shock increases the possibility of relocating from period to period.

Hypothesis 2: *A smaller adjustment cost leads to a higher possibility of adjusting the committed consumption, conditional on the income shock to the head of the family.*

I compare the case of having commitments to the extreme case of no transaction cost in Figure 1.3. In the presence of a positive adjustment cost, there is an "inaction" area where the household doesn't move away from previous commitments. In contrast, in the case of no adjustment cost, the household will constantly adjust both types of consumption. It can be inferred that a smaller adjustment cost makes it easier to deviate from previously committed expenses and to re-optimize on all margins. Intuitively, adjustment costs are relatively lower for renters compared with homeowners still paying mortgages. This allows renters to move more frequently in the face of unexpected income fluctuations.

Chetty and Szeidl (2007) perform an event study and graphically show how different types of consumption respond differently around workers' unemployment spells. They provide empirical evidence that during periods of unemployment, PSID families who were still renting adjusted housing expenditures more frequently, and were more likely to change all types of consumption simultaneously. In Section 1.4, I perform econometric analysis to confirm their finding that renters were more flexible in adjusting due to lower moving costs, compared with homeowners. More specifically, renters were more likely to relocate after job-displacement shocks to the head of the family.

Hypothesis 3 (for non-movers): *A higher share of income spent on commitments ex ante leads to a stronger added worker effect upon an income shock to the head of the family, conditional on the head's previous income.*

With small and moderate income shocks, changes in consumption goods concentrate more on adjustables and less on commitments such as mortgage payments, car installments and health insurance. Families with greater consumption commitments have fewer opportunities to engage

in the intratemporal substitution of leisure for consumption goods, and wives will be motivated to provide more market labor to avoid sharp reductions in flexible goods. Throughout this paper, the precommitted share is defined by the ratio of the mortgage or rent to the income of the head of the family in the period prior to the head's unemployment shock. The income shock was received in a period when a PSID respondent reported being unemployed after continuous employment for two periods. It can be inferred from Figure 1.3 that conditional on the head's initial income (y^h), a higher precommitted share implies a more elastic spousal labor supply, particularly within the inaction area. The household tries hard to avoid a costly adjustment in the commitments, when the income shock is only temporary or moderate relative to its lifetime earnings. If the family previously devoted a substantial portion of its total income to inflexible goods, then upon an unemployment shock, additional labor supply and extra earnings from the wife will become more valued. Accordingly, wives from families in similar scenarios have a stronger motivation to participate in the labor force to help pay the mortgage or the rent.

To better identify the key variables to be included in the estimation in Section 1.4, I derive the precise equations regarding the spousal labor response to the head's income change. Details of the solutions are shown in Appendix A.3. In general, the income elasticity of spousal labor supply is governed by the head's income prior to the shock (y), the ratio of asset holdings to the income (A_{-1}/y), and the precommitted share (k/y). Conditional on the asset ratio and income level, a higher precommitted share makes the wife more sensitive to the head's income change. In the particular case with risk preference parameters and Frisch elasticity of labor supply all equal to 1 ($\sigma = \gamma = \eta = 1$), the income elasticity of the spousal labor supply takes a parsimonious form:

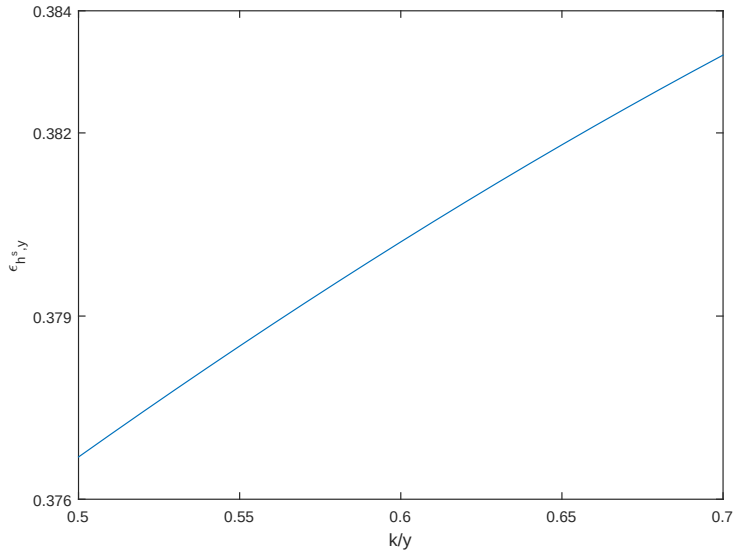
$$\varepsilon = -\frac{dh}{dy} \cdot \frac{y}{h} = \frac{1}{\sqrt{\frac{4w^2}{\delta y^2} + \left(1 + \frac{\Gamma}{y} - \frac{k}{y}\right)^2}} \tag{1.6}$$

where $\Gamma = f(\beta, T) \cdot A_{-1}$. Figure 1.5 shows the relationship between the precommitted share and the income elasticity of spousal labor supply in this special case. y is given the value of 1, and other parameters are as given in Table 1.2. It is evident that a higher precommitted share of the head's income devoted to inflexible consumption is associated with a greater income elasticity of spousal labor supply.

1.4 Estimation Strategy and Results

Subsection 1.3.3 forms three important hypotheses which can be used to support the importance of consumption commitments for household behavior. This section discusses the estimation strategy

Figure 1.5: Precommitted Share and Income Elasticity of Spousal Labor Supply



NOTE: See the model setup in Subsection 1.3.1 and parameter values in Subsection 1.3.3, *Hypothesis 3*. The y-axis is the income elasticity of spousal labor supply with respect to the head's income. The x-axis is the ratio of committed consumption to the head's income.

to test these hypotheses one by one.[11] I use the PSID data from 1968 to 1997 to perform the estimation.[12] PSID main interviews provide detailed information on labor market experiences, wealth portfolios, educational attainment and other demographic characteristics for both the head and wife (if any) in the family.

1.4.1 Differential Relocation Responses to Large vs. Small Shocks

Hypothesis 1 proposes that a household is less likely to give up commitment consumption upon small or moderate income changes because an adjustment can be costly. This implies that in the real life, families are more likely to move when income shocks are bigger in the presence of committed spending such as mortgages.[13] This subsection performs econometric estimation to test whether a household's decision to adjust commitments indeed was affected by the magnitude of

[11] For most regression specifications in this section, I implicitly rely on the rational expectation to justify the exogeneity of regressors.

[12] I use this particular sample period mainly because the PSID is annual up to 1997. Since I need to identify employment status, as well as other statuses, such as change of head and marital status, for two continuous years prior to the head's unemployment shock, I exclude the period after 1997 for estimation.

[13] Refinancing during economic difficulties can be another channel for relief from large commitments, but due to the lack of refinancing information during the sample period, it is hard to compare these two options.

the head's unemployment shock. The following regression equation is estimated:

$$\text{logit}(\pi_{i,t}) = \beta_0 + \beta_1 Shock_{i,t} + \gamma_1 X_{i,t} + \gamma_2 State_{s_i,t} + Year_t + \varepsilon_{i,t} \tag{1.7}$$

where $\pi_{i,t} = prob(\Delta k_{i,t} \neq 0 | Shock_{i,t}, X_{i,t}, State_{s_i,t}, Year_t)$. "$\Delta k_{i,t} \neq 0$" indicates there is an adjustment in committed consumption. As discussed in Subsection 1.3.3, because the information regarding households' choices to move is consistently reported in the PSID, the relocation decision is used to construct a proxy for the adjustment in commitments.[14]

The sample is limited to families with a wife present in the family unit, and with the head aged between 24 and 54. The sample excludes observations with any change in the household composition. For each observation of household i in year t, there was no change in the head of the family from $(t-2)$ to t. Neither was there any breaking up or change in the number of people in the family during this period. The reason for the choice of 24 is to mitigate the possibility that the head's income decline was due to the pursuit of higher education. It is further limited to families in which the head had been continuously employed for two consecutive years prior, year $(t-1)$ and year $(t-2)$, but reported being unemployed in year t as indicated in the equation.[15] Continuous employment for two years before year t guarantees that the income stream coming from the head was relatively stable prior to the year being studied, when the head's labor income was negatively affected. The sample period spans from 1968 to 1997. All nominal variables, such as income, wealth, and consumption, are CPI-adjusted to 2007 constant U.S. dollars.

The key explanatory variable, $Shock_{i,t}$, is defined in the same fashion as in Chetty and Szeidl (2007). It is classified according to the log change of the head's reported income in family i from year $(t-1)$ to t with an unemployed spell in t.[16] If the log change in the head's income from the previous year is between 0 and -33 percent, then $Shock_{i,t}$ is categorized as a "small" one and set to zero. Otherwise, if the income loss is bigger than 33 percent, it is classified as a "big" change and $Shock_{i,t}$ is set to one. Since the data for the head's wages and salaries has been consistently reported since 1968, it is used for the calculation. $X_{i,t}$ denotes some commonly used demographic variables. It includes the head's age and age squared, the number of family members and the square

[14] Using the PSID data, I verify that moving during an unemployment spell is associated with a decrease in housing spending by 11 log points on average. The drop in housing expenses is greater for homeowners (35 log points) and smaller for renters (only 2 log points).

[15] I define an individual's employment status in the same way as in Chetty and Szeidl (2007). A respondent is considered as employed if he/she reported "working now, or only temporarily laid off," and as unemployed if he/she reported "unemployed and looking for work." The reason for this is that prior to 1976, both employed and temporarily laid off individuals were included in one category. After that, this category has been divided into two separate categories. To maximize the number of observations used in the estimation, I create a single category consistent with that prior to 1976.

[16] In practice, the hyperbolic sine transformation is applied to include observations with zero income: $\Delta log(y_{i,t}) = log(y_{i,t} + \sqrt{1+y_{i,t}^2}) - log(y_{i,t-1} + \sqrt{1+y_{i,t-1}^2})$.

of that number, head's and wife's educational attainment, whether having a child under age six and the race of the head in year t. $State_{s_i,t}$ includes the state-fixed effect, real personal income per capita and local unemployment rate in the state where household i lived in year t. These state-level variables describe local economic conditions and labor market opportunities, and help to account for state-level policies that can possibly affect employment and housing. $Year_t$ is the year-fixed effect. The source of income changes matters. If the change in the head's income is due to local labor market conditions, then the wife can be affected as well independently of the husband's employment. The impact caused by local economic conditions can be controlled by the state-level variables ($State_{i,t}$) as well as the year-fixed effect ($Year_t$).

Estimation results are reported in Table 1.3. The key coefficient examined here is β_1 for $Shock_{i,t}$, which indicates whether a bigger unemployment shock to the head induces the family to adjust commitments by moving to a difference place of residence. In the baseline specification shown in column (1), the sample is limited to families with the head continuously employed for two years prior to the unemployment in the current period. It is evident that a family is more likely to move in the current year if the head of the family experiences an income loss greater than 33 percent, compared with one having an income drop of less than 33 percent. The marginal effect of experiencing a large unemployment shock versus a small one is a 3.4-percentage-point increase in the likelihood of moving. In the alternative specification, the log value of home equity is added to account for the fact that families with more home equity may have more resources to smooth consumption during temporary unemployment spells and are less likely to be forced to abandon commitments.[17] In this case, the estimated result shows that more home equity relieves the pressure to relocate during an unemployment spell. However, the influence of a big income shock still persists. The estimated marginal effect of a large income cut increases the probability of moving from previous period by 3.5 percentage points.

1.4.2 The Dependence of Relocation Decisions on Adjustment Costs

Hypothesis 2 proposes that smaller adjustment expenses of commitment goods lead to more frequent adjustments in inflexible consumption, conditional on the income change of the head of the family. In real life, homeowners need to pay several percentage points of a home's value to be able to walk away from their present residence and move to a new one, which can require tens of thousands of dollars. In contrast, renters usually only need to pay several months of rent to break a lease agreement. This implies that renters are more likely to move compared with mortgage holders, given the same magnitude of an unemployment shock to the head of household. This

[17] In practice, the hyperbolic sine transformation is applied to include families with negative or zero home equity. With this transformation, renters have zero value for this variable (*log of Home Equity*).

Table 1.3: Differential Relocation Responses to Large vs. Small Unemployment Shocks

	(1)	(2)
	Logit	*Logit*
Big Shock	0.29***	0.32***
	(0.10)	(0.11)
log(Home Equity)		-0.47***
		(0.05)
Observations	6,025	5,155
Margin. Effect (Big Shock)	+3.4 p.p.	+3.5 p.p.

NOTE: Annual PSID data from 1968 to 1997. Detailed sample descriptions and variable definitions are discussed in Section 1.4.1. The outcome variable is whether a family moved since the previous interview. *Big Shock* indicates an income loss greater than 33 percent from the previous period for a head who reported unemployment in the current period. *Home Equity* is zero for renters and log of the real home equity for homeowners. All the covariates in eqn.(1.7) are included. PSID family weights are used for calculations.
Standard errors are reported in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

subsection performs econometric estimation to test whether a household's decision to relocate was affected by the magnitude of the adjustment cost. The following regression equation is estimated:

$$\text{logit}(\pi_{i,t}) = \beta_0 + \beta_1 Shock_{i,t} + \beta_2 CC_{i,t-1} + \beta_3 Shock_{i,t} \cdot CC_{i,t-1} + \gamma_1 X_{i,t} + \gamma_2 State_{s_i,t} + Year_t + \varepsilon_{i,t}, \quad (1.8)$$

where $\pi_{i,t} = Pr(\Delta k_{i,t} \neq 0 | Shock_{i,t}, CC_{i,t-1}, X_{i,t}, State_{s_i,t}, Year_t)$. The sample selection criteria are similar to those in subsection 1.4.1. Most importantly, it is limited to families in which the head had been employed in year $(t-1)$ and year $(t-2)$, but reported unemployment in year t.

As in subsection 1.4.1, $Shock_{i,t}$ is a dummy variable indicating whether the log change of the head's reported income in family i from year $(t-1)$ to t is greater than 33 percent. The key distinction between eqn.(1.7) and eqn.(1.8) is the addition of one variable, $CC_{i,t-1}$. This helps to identify differential motivations to adjust between homeowners and renters. $CC_{i,t-1}$ is set to 1 for homeowners and otherwise set to 0. If higher adjustment costs for homeowners reduce the frequency of moving over time after a job displacement, then β_2 for $CC_{i,t-1}$ is expected to be negative. $X_{i,t}$ denotes the same set of demographic variables as in subsection 1.4.1. $State_{s_i,t}$ includes the state-fixed effect, local unemployment rate and real personal income per capita. $Year_t$ is the year-fixed effect.

Estimation results are reported in Table 1.4. The key coefficients identified here are β_2 for $CC_{i,t-1}$ and β_3 for the interaction term of $Shock_{i,t}$ and $CC_{i,t-1}$. From the baseline result in column (1) of Table 1.4, I can compare the relocation possibilities in different scenarios. The benchmark

is for renters with the head of the family receiving a small income shock during the unemployment spell. β_2 implies that being homeowners substantially lower the chance of moving away from the previous place of residence. In addition, a big negative income shock can offset the impact of home ownership on the possibility of moving, as shown by the interaction coefficient β_3. I calculate the marginal probabilities of moving in four scenarios as shown below. For renters with a small un-

	SMALL SHOCK	BIG SHOCK
RENTERS	0.27	0.29
HOMEOWNERS	0.10	0.14

employment shock, the probability of moving is 27 percent. A large shock increases the marginal probability for this group by 2 percentage points. In contrast, homeowners with a small income drop have only a 10-percent chance of abandoning their previous place of residence, a sharp reduction of 17 percentage points. The possibility of relocation increases by 4 percentage points if the income shock to the head who owns a home upon the job displacement is a big one. Table 1.4 reports that being a homeowner decreases the probability of moving by 15.7 percentage points on average. Column (2) of Table 1.4 reports estimated coefficients for an alternative specification. To account for the fact that accumulated wealth influences a household's decision during economic difficulties, the log of home equity is added as a vital explanatory variable. The estimated result shows that more home equity reduces the likelihood of an adjustment when the head of the family experiences an unemployment spell. More financial resources upon an income loss ease the pressure to deviate from precommitments. In the alternative specification, the marginal effect of being a homeowner instead of a renter reduces the chance of moving during an unemployment spell by almost 13 percentage points.

In summary, the empirical evidence provided in this subsection supports the proposed hypothesis in Subection 1.3.3, *Hypothesis 2*, that a higher adjustment cost in housing consumption results in less adjustment on that margin.

1.4.3 Committed Consumption and Spousal Labor Supply

This subsection provides empirical evidence to test *Hypothesis 3*, proposed in Subsection 1.3.3. Specifically, it examines how precommitments affect spousal labor supply in the short term when the head of the family experiences a negative income shock. As shown in Section 1.2, committed consumption is infrequently adjusted relative to non-committed goods. Chetty and Szeidl (2007) find that this special property of commitments amplifies risk aversion under moderate shocks, when an adjustment in commitments is not triggered. Due to a similar reason, the amplification of risk aversion motivates the wife of a family to provide more labor when the head experiences a negative

Table 1.4: The Dependence of Relocation Decisions on Adjustment Costs

	(1)	(2)
	Logit	*Logit*
Big Shock	0.13	0.06
	(0.11)	(0.15)
Own Home	-1.32***	-1.34***
	(0.13)	(0.25)
Big Shock and Own Home	0.26*	0.49**
	(0.16)	(0.22)
log(Home Equity)		-0.19***
		(0.07)
Observations	5,813	5,155
Margin. Effect (Own Home)	-15.7 p.p.	-12.7 p.p.

NOTE: Annual PSID data from 1968 to 1997. Detailed sample descriptions and variable definitions are discussed in Section 1.4.2. The outcome variable is whether a family moved since the previous interview. *Big Shock* indicates an income loss greater than 33 percent from the previous period for the head reporting unemployment in the current period. *Own Home* indicates that the family owned a home prior to the head's unemployment shock. *Home Equity* is zero for renters and log of the real home equity for homeowners. All the covariates in eqn.(1.8) are included. PSID family weights are used for calculations.
Standard errors are reported in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

income shock unexpectedly. A higher share of family income devoted to inflexible consumption prior to the shock implies increasing difficulty in adjusting the consumption composition. In theory, there should be a positive association between the precommitted share and added worker effect, given the same magnitude of shock. The hypothesis tested in this subsection is whether the wife of household has a stronger motivation to work more when the head faces unemployment if a greater share of family income is committed to inflexible expenditures.

To provide convincing statistical evidence for the hypothesis above, two sets of regressions are estimated. The first set is what I call "*Event Study*." It only utilizes the period of the reported unemployment spell for the head, without taking into the account the magnitude of the income change during this period. The first set of regression equations is as follows:

$$Outcome_{i,t} \;=\; \beta_0 + \beta_1(k/y)_{i,t-1} + \gamma_1 Y_{i,t-1} + \gamma_2 X_{i,t} + \gamma_3 State_{s_{i,t}} + Year_t + \varepsilon_{i,t}. \quad (1.9)$$

For wives out of the labor force or not working prior to their heads' unemployment shock, the outcome variables include $EnterLF_{i,t}$, $EnterEmp_{i,t}$, $\Delta Hrs_{i,t}$ and $\Delta log(Hrs_{i,t})$. $EnterLF_{i,t}$ is a dummy indicating whether the wife of family i was a new entrant to the labor force in year t. It is set to 1 if the wife reported being either unemployed or employed in year t, and otherwise equals 0. For outcome variables $EnterEmp_{i,t}$, $\Delta Hrs_{i,t}$ and $\Delta log(Hrs_{i,t})$, the sample is limited to families with the wife reporting zero working hours in year $(t-1)$, before the head experienced a job displacement in t. $EnterEmp_{i,t}$ indicates whether the wife in family i worked with positive hours in year t. It is equal to 1 if the wife, not working in year $(t-1)$, began to work in year t. $\Delta Hrs_{i,t}$ is the change in spousal working hours from year $(t-1)$ to t in family i. $\Delta log(Hrs_{i,t})$ is the log change of hours. For wives already employed and working for a positive amount of time prior to the shock, the outcome variables include $\Delta PosHrs_{i,t}$ and $\Delta log(PosHrs_{i,t})$. These two variables are the change in spousal annual working hours and in the log of hours from $(t-1)$ to t in family i.

$(k/y)_{i,t-1}$ is the ratio of commitment consumption to the family head's income in year $(t-1)$. The particular form of this ratio (k/y) is taken directly from the derivation in eqn.(1.6).[18] PSID recorded information on mortgages and rent in each year since 1968.[19] Therefore, the commitment share is calculated by dividing housing expenditures by the head's reported wages and salaries. The spousal labor supply responses for homeowners and renters are estimated separately. $(k/y)_{i,t-1}$ is the mortgage over the head's income in t for homeowners, and yearly rent over the income for renters. $Y_{i,t-1}$ includes the head's prior income and income squared. $Y_{i,t-1}$ is included because

[18] In one robustness check, I include the estimation results for which the ratio is calculated by dividing the housing costs by total income from both the head and the wife.

[19] Rent information is missing for 1988 and 1989. Mortgage information is missing for 1973-1975, 1982, 1988 and 1989.

from eqn.(1.6), the amplification of a higher committed share on the spousal labor supply response is conditional on the head's initial income prior to the unemployment shock. Although the PSID data lacks information on financial assets, the ratio of home equity over the head's income in $(t-1)$ is used as a proxy for the wealth ratio (A_{-1}/y) shown in eqn.(1.6) for homeowners.[20] $X_{i,t}$, $State_{s_i,t}$ and $Year_t$ are defined in the same way as in the previous two subsections.

The second set of regression equations is what I call "*Income Elasticity*." It not only utilizes the unemployment spell for the head, but also takes into account the magnitude of the income shock during this period. The associated regression form is:

$$Outcome_{i,t} = \beta_0 + \beta_1 \Delta log(y_{i,t}) + \beta_2 (k/y)_{i,t-1} \cdot \Delta log(y_{i,t}) + \gamma_1 Y_{i,t-1} \cdot \Delta log(y_{i,t}) + \gamma_2 X_{i,t} \cdot \Delta log(y_{i,t}) + \gamma_3 State_{s_i,t} + Year_t + \varepsilon_{i,t}, \quad (1.10)$$

where the outcome and explanatory variables are the same as in eqn.(1.9). $\Delta log(y_{i,t})$, in eqn.(1.10) is the log change of the head's reported labor income in family i from year $(t-1)$ to t. In practice, the hyperbolic sine transformation is applied to include observations with zero income.

The sample selection criteria are similar to those in Subsection 1.4.1 and Subsection 1.4.2, in addition to those mentioned beneath eqn.(1.9). Both the head and the wife need to be present in the family, with the head aged between 24 and 54. There should be no change in the family composition such as who the head of the family is from $(t-2)$ to t. The head must have been employed continuously for two periods before reporting an unemployment spell in t. All nominal variables are CPI-adjusted to 2007 constant U.S. dollars. As proposed in *Hypothesis 3*, the spousal labor supply response to the head's income change is supposed to be stronger when a higher share of the head's income was devoted to commitments, conditional on there being no adjustment in the committed consumption (denoted as k). Since housing spending is used as a proxy for commitments, the sample is further limited to households staying in the same place of residence as in the previous period, upon the head's job displacement in the current year.

The key coefficients examined are β_1 for $(k/y)_{i,t-1}$ in eqn.(1.9) in the case of "*Event Study*," and β_2 for the interaction term of the head's income change and the precommitted share in eqn.(1.10) in the case of "*Income Elasticity*." If commitments induce wives to have stronger responses when their partners receive income cuts, then I should expect a positive sign of β_1s in the case of "*Event Study*" and a negative sign of β_2s in the case of "*Income Elasticity*" across all specifications. Estimation results corresponding to Eqn.(1.9) and Eqn.(1.10) for homeowners are shown in Table 1.5. Estimated key coefficients for renters are reported in Table 1.6. The PSID data used for econometric analyses expanded from 1968 to 1997. It is evident that the precommitted share of inflexible

[20] Hurst and Stafford (2004) show that households tapped into home equity when they became unemployed and had limited assets.

consumption does affect the impact of a head's unemployment shock on the spousal labor supply response, in terms of both labor force participation and hours worked.

The first two columns in Tables 1.5 - 1.6 show how wives adjusted their labor participation or working status after their husbands experienced unemployment and negative income changes. First, in Table 1.5 of "*Event Study*," the estimated β_1 for the variable $(k/y)_{i,t-1}$ in column (1) shows that a wife who was previously out of the labor force was more likely to enter the labor force during the head's unemployment spell, if the family devoted a higher share of its income to mortgage payments. A 10-percentage-point increase in the precommitted share of housing spending for homeowners increases the overall spousal labor participation rate upon the head's unemployment shock by 1.9 percentage points. Similarly, column (2) shows that the spousal employment rate was raised by a higher precommitted share of housing costs. With a 10-percentage-point increase in the preommitment share for homeowners, the likelihood of becoming employed after the head's unemployment increases by 4.2 percentage points. Second, the estimated coefficients for the interaction term in Table 1.5 of "Income Elasticity" confirm that having committed a higher share of family income to inflexible goods induces the wife to enter the labor force and work for a positive amount of time during the family head's job displacement. With the same increase in the precommitted share, the likelihoods of becoming a new entrant to the labor force and becoming employed rise by 2.1 and 2.7 percentage points. In contrast to homeowners, the estimated marginal effect of a higher precommitted share on renters is weaker. In both cases for renters shown in Table 1.6, a 10-percentage-point increase in the precommitted share increases the probability of the wife entering the labor market by merely 0.1-1.2 percentage points, while it barely affects the employment rate. This is consistent with the intuition that lower opportunity costs for renters to relocate lead to weaker spousal labor supply responses.

In terms of the change in spousal working hours along the extensive margin, the estimation results for homeowners exhibit similar patterns to those for renters. From column (3) and column (4) shown in Panel A of Table 1.5, a higher precommitted share for homeowners consistently results in more hours worked by the wife after the head's reported unemployment. A 10-percentage-point increase in the precommitted share motivates the wife to provide almost 80 more hours after entering the labor force. If the log change is used instead, the same increase in the precommitments raises the log change by 1.7 points. In the case of "*Income Elasticity*" for homeowners, the estimated marginal effect is modestly greater than that in the case of "*Event Study*." The change in hours worked increases by around 140 hours after the wife becomes a new entrant, and the log change is raised by 2.1 log points. The change in spousal hours worked for renters is not substantially different from that for homeowners. From column (3) and column (4) in Table 1.6, a 10-percentage-point increase in the income share committed to rent makes the wife work 59-142 more hours once the wife begins to work upon the head's job displacement. Using the alternative

Table 1.5: Consumption Commitments and Spousal Labor Supply (Homeowners)

(non-movers)	WIFE NOT WORKING PRIOR				WIFE WORKING PRIOR	
	(1)	(2)	(3)	(4)	(5)	(6)
	Enter L.F.	Enter Emp.	ΔHours	ΔlogHours	ΔHours	ΔlogHours
	Logit	*Logit*	*Tobit*	*OLS*	*OLS*	*OLS*
A. Event Study						
Mortgage Share Prior	0.97***	3.28***	0.77***	0.17**	-0.05	-0.04
	(0.31)	(1.21)	(0.08)	(0.08)	(0.08)	(0.05)
Equity Share Prior	-0.01	-0.06***	-0.01***	-0.00*	-0.00	-0.00
	(0.01)	(0.02)	(0.00)	(0.00)	(0.00)	(0.00)
Head Income Prior	0.06	0.62***	0.22***	0.01	-0.00	-0.01
	(0.04)	(0.14)	(0.01)	(0.01)	(0.01)	(0.01)
(Head Income)^2 Prior	-0.00	-0.03***	-0.01***	-0.00	0.00	0.00
	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Obs.	761	961	961	961	1,796	1,796
Margin. Effect (+10 p.p. in Mort. Share)	+1.9 p.p.	+4.2 p.p.	+78 hrs	+1.7 log pt.	-5 hrs	-0.4 log pt.
B. Income Elasticity						
Δ log(Head Income)	-1.66	18.74***	-6.73***	-1.41**	2.05***	1.67***
	(4.50)	(6.21)	(2.39)	(0.65)	(0.61)	(0.40)
× Mortgage Share Prior	-6.05**	-8.79***	-4.11***	-0.59*	-0.44*	-0.36***
	(2.83)	(3.06)	(1.32)	(0.32)	(0.23)	(0.13)
× Equity Share Prior	0.01	0.54***	0.24***	0.07***	0.03**	0.02***
	(0.12)	(0.21)	(0.04)	(0.02)	(0.01)	(0.01)
× Head Income Prior	-0.13	0.55***	-0.24***	-0.02	-0.01**	0.01
	(0.20)	(0.18)	(0.09)	(0.02)	(0.03)	(0.02)
× (Head Income)^2 Prior	0.04**	0.01	0.02**	0.00*	-0.00	0.00
	(0.02)	(0.02)	(0.01)	(0.00)	(0.00)	(0.00)
Obs.	761	961	961	961	1,796	1,796
Margin. Effect (+10 p.p. in Mort. Share)	+2.1 p.p.	+2.7 p.p.	+143 hrs	+2.1 log pt.	+14 hrs	+1.1 log pt.

NOTE: Annual PSID data from 1968 to 1997. Detailed sample descriptions and variable definitions are discussed in Section 1.4.3. $EnterL.F.$ is a dummy indicating whether the wife was a new entrant to the labor market after the head's unemployment shock in year t. $EnterEmp.$ is a dummy indicating whether the wife began to work in year t after the shock. ΔHours and ΔlogHours are the change in hours and in the log of hours worked by the wife from $(t-1)$ to t. *Mortgage Share* is the ratio of yearly mortgage payments to the head's income in $(t-1)$. *Equity Share* is the ratio of home equity to the head's income in $(t-1)$. *Head Income* is the head's wages and salaries in tens of thousand dollars in year t. Δ *log(Head Income)* is the log change of the head's wages and salaries from year $(t-1)$ to t, conditional on experiencing an unemployment spell in t. All the covariates in eqn.(1.9) and (1.10) are included. PSID family weights are used for calculations.

Standard errors are reported in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 1.6: Consumption Commitments and Spousal Labor Supply (Renters)

(non-movers)	WIFE NOT WORKING PRIOR				WIFE WORKING PRIOR	
	(1)	(2)	(3)	(4)	(5)	(6)
	Enter L.F.	Enter Emp.	ΔHours	ΔlogHours	ΔHours	ΔlogHours
	Logit	*Logit*	*Tobit*	*OLS*	*OLS*	*OLS*
A. Event Study						
Rent Share Prior	1.49	0.24	0.59***	0.30***	-0.07	0.01
	(0.91)	(0.86)	(0.04)	(0.06)	(0.17)	(0.06)
Head Income Prior	-0.19	2.13***	0.22***	0.00	-0.06	-0.11***
	(0.37)	(0.34)	(0.00)	(0.03)	(0.07)	(0.03)
(Head Income)^2 Prior	0.02	-0.24***	0.00***	0.01*	0.01	0.01***
	(0.06)	(0.07)	(0.00)	(0.01)	(0.01)	(0.00)
Obs.	326	589	589	589	812	812
Margin. Effect (+10 p.p. in Rent Share)	+1.2 p.p.	+0.3 p.p.	+59 hrs	+3.0 log pt.	-7 hrs	+0.1 log pt.
B. Income Elasticity						
Δ log(Head Income)	139.70***	64.01	25.52***	4.70***	-0.16	-0.82
	(31.48)	(48.75)	(0.06)	(1.27)	(1.09)	(0.81)
× Rent Share Prior	-1.57	-2.18	-6.18***	-0.19	-2.07***	-0.98*
	(9.79)	(17.61)	(0.19)	(0.59)	(0.78)	(0.51)
× Head Income Prior	-3.33	0.14	-2.46***	-0.49***	0.12	0.09
	(2.45)	(1.48)	(0.04)	(0.18)	(0.12)	(0.08)
× (Head Income)^2 Prior	0.10	-0.28*	0.29***	0.07*	-0.02	-0.02
	(0.24)	(0.15)	(0.01)	(0.04)	(0.02)	(0.01)
Obs.	326	589	589	589	812	812
Margin. Effect (+10 p.p. in Rent Share)	+0.1 p.p.	+0.4 p.p.	+142 hrs	+1.0 log pt.	+49 hrs	+2.3 log pt.

NOTE: Annual PSID data from 1968 to 1997. Detailed sample descriptions and variable definitions are discussed in Section 1.4.3. $EnterL.F.$ is a dummy indicating whether the wife was a new entrant to the labor market after the head's unemployment shock in year t. $EnterEmp.$ is a dummy indicating whether the wife began to work in year t after the shock. ΔHours and ΔlogHours are the change in hours and in the log of hours worked by the wife from $(t-1)$ to t. ***Rent Share*** is the ratio of yearly rent payments to the head's income in $(t-1)$. ***Head Income*** is the head's wages and salaries in tens of thousand dollars in year t. **Δ *log(Head Income)*** is the log change of the head's wages and salaries from year $(t-1)$ to t, conditional on experiencing an unemployment spell in t. All the covariates in eqn.(1.9) and (1.10) are included. PSID family weights are used for calculations.

Standard errors are reported in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

indicator, the same change in commitments leads to a 1-3 point increase in the log change of hours.

The discussion so far has been limited to the extensive margin of the added worker effect, in terms of labor participation and the switch from being unemployed to employed. Column (5) and column (6) in Table 1.5 and Table 1.6 show the estimation results on the intensive margin, for families with the wife already working before the head's unemployment and income loss. I assume again that the precommitted share goes up by 10 percentage points. On average, wives from families having their own homes are estimated to work at most 14 hours more in response to the heads' income cuts during the first year of an unemployment shock. Similarly, the log of hours worked by wives previously employed rises by approximately 1.1 percentage points in the case of "*Income Elasticity*." Estimation results show that the spousal labor supply response is similar for families which choose to rent instead of owning their homes. When the rent share relative to the head's income goes up by 10 percentage points, the change in hours worked by the wife increases by up to 49 hours as shown in Table 1.6. The change in the log of hours goes up by at most 2.3 percentage points.

Although this paper doesn't examine the persistence of unemployment shocks, I study the impact of commitments on the spousal labor supply response one year after the husband's adverse income experience. The change in each outcome variable is from period $(t-1)$ to $(t+1)$. The same estimation strategy is applied and the results are reported in Table 1.7. The overall patterns still persist regardless of which approaches are used. Comparing Table 1.5 with Table 1.7, I find that the influence of consumption commitments on the added worker effect extends to one year after the unemployment shock. Estimation results for the current period of the shock are quite similar to those for one period ahead. Only the change in (log)hours on the extensive margin, shown in column (3) and column (4), is modestly smaller in the one-year-ahead scenario. It is worth noting that adjustments on the extensive margin are still more noticeable than those on the intensive margin.

In summary, by utilizing the PSID data, I find strong empirical evidence that consumption commitments, particularly housing expenses, can affect the added worker effect when the head of the family experiences unexpected negative income fluctuations. The higher adjustment costs of committed goods make it harder to adjust within a short period of time, which motivates the wife to provide more market labor. The majority of estimation results from various specifications confirm that the added worker effect is stronger for families which commit a greater portion of family income to inflexible goods. This paper also discovers that the extensive margin of spousal labor supply adjustment is consistently stronger than the intensive margin.

Table 1.7: Consumption Commitments and Spousal Labor Supply (Homeowners): One Year Ahead

(non-movers)	WIFE NOT WORKING PRIOR				WIFE WORKING PRIOR	
	(1)	(2)	(3)	(4)	(5)	(6)
	Enter L.F.	Enter Emp.	ΔHours	ΔlogHours	ΔHours	ΔlogHours
	Logit	*Logit*	*Tobit*	*OLS*	*OLS*	*OLS*
Event Study						
Mortgage Share Prior	0.53	2.34***	0.63*	0.09	-0.07	-0.04
	(0.43)	(0.76)	(0.34)	(0.12)	(0.10)	(0.07)
Equity Share Prior	-0.02	-0.03	-0.01	-0.01***	-0.00	-0.00
	(0.02)	(0.03)	(0.01)	(0.00)	(0.01)	(0.00)
Head Income Prior	0.22***	0.35***	0.20***	0.09***	0.01	-0.00
	(0.07)	(0.09)	(0.04)	(0.01)	(0.02)	(0.01)
(Head Income)^2 Prior	-0.00	-0.01***	-0.01***	-0.00***	-0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Obs.	690	802	802	802	1,612	1,612
Margin. Effect	+0.8 p.p.	+2.6 p.p.	+63 hrs	+0.9 log pt.	-7 hrs	-0.4 log pt.
(+10 p.p. in Mort. Share)						
Income Elasticity						
Δ log(Head Income)	24.06***	7.39	4.43**	1.30*	-0.17	1.08**
	(6.86)	(8.82)	(2.09)	(0.71)	(0.74)	(0.44)
× Mortgage Share Prior	-11.81*	-16.29***	-4.13**	-0.89***	-0.33	-0.06
	(6.21)	(4.29)	(1.72)	(0.31)	(0.23)	(0.15)
× Equity Share Prior	1.32***	0.89***	0.26***	0.07***	0.03***	0.03***
	(0.36)	(0.27)	(0.05)	(0.01)	(0.01)	(0.01)
× Head Income Prior	-0.01	0.44**	0.09	0.04*	-0.05*	0.00
	(0.19)	(0.22)	(0.10)	(0.02)	(0.03)	(0.02)
× (Head Income)^2 Prior	0.02	-0.01	0.01	0.00	-0.01***	-0.01***
	(0.02)	(0.02)	(0.01)	(0.00)	(0.00)	(0.00)
Obs.	690	802	802	802	1,612	1,612
Margin. Effect	+2.2 p.p.	+3.2 p.p.	+66 hrs	+1.4 log pt.	+1 hrs	+0.1 log pt.
(+10 p.p. in Mort. Share)						

NOTE: Annual PSID data from 1968 to 1997. Sample selection criteria and variable definitions are similar to those in Table 1.5 and Table 1.6. The outcome variables indicate changes in spousal employment status and working time from $(t-1)$ to $(t+1)$, where t is the first period when the head reported unemployment. All the covariates in eqn.(1.9) and (1.10) are included. PSID family weights are used for calculations.
Standard errors are reported in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

1.5 Robustness Checks

1.5.1 Adding Unemployment Insurance

In Section 1.4, only the change in the head's labor income is used to estimate the impact of committed consumption on the income elasticity of spousal labor supply. When the head is unemployed unexpectedly, normally he can receive unemployment compensation for several weeks or even months before he gets re-employed. Intuitively, unemployment insurance (UI) payments to the husband induce a smaller response by the wife. For a robustness check, I include the change in UI to the baseline specification for the homeowners.[21] The addition of unemployment compensation normalized by the head's income doesn't affect the key conclusion regarding the impact of commitments on spousal labor supply response to the head's income shock (Panel A of Table 1.8). The estimated coefficients reveal that an increase in the receipt of UI by the husband attenuates the wife's labor supply response, especially along the extensive margin.

1.5.2 An Alternative Calculation of Ratios

The mortgage/rent ratio and the equity ratio used in the econometric analyses in Section 1.4 are calculated by dividing the housing spending and home equity by the head's income. This form of calculation is taken from the expression of the income elasticity of spousal labor supply shown in eqn.(1.6). In this subsection, I re-calculate these ratios by dividing housing costs and home equity by the total labor income from both the head and the wife in the family. The results are shown in Panel B of Table 1.8. It is evident that using the alternative ratios hardly affects the results regarding the impact of commitments on the added worker effect.

In summary, Section 1.5 confirms that the amplification of higher precommitments on the spousal labor supply survives various plausible specifications. If a household devotes more financial resources to housing expenditures prior to the head's unemployment shock, the wife is more likely to enter the labor force and become employed.

1.6 Other Household Decisions

Most of the previous sections discuss the impact of commitments on the added worker effect within the family. Section 1.6 links committed consumption to other important aspects of household decision-making.

[21] I use the actual UI benefits received to perform the robustness check, which could suffer from the endogeneity problem. The potential UI benefits faced by the head would serve a better purpose in this case.

Table 1.8: Robustness Checks of the Impact of Commitments on Spousal Labor Supply

(non-movers)	WIFE NOT WORKING PRIOR				WIFE WORKING PRIOR	
	(1)	(2)	(3)	(4)	(5)	(6)
	Enter L.F.	Enter Emp.	ΔHours	ΔlogHours	ΔHours	ΔlogHours
	Logit	*Logit*	*Tobit*	*OLS*	*OLS*	*OLS*
A. Income Elasticity - Add UI						
Δ log(Head Income)	-2.91	35.83***	16.60***	0.47	1.86***	1.37***
	(4.85)	(9.94)	(5.33)	(0.74)	(0.72)	(0.47)
× Mortgage Share Prior	-6.34**	-30.00***	-1.81	-0.37	-0.06	-0.23
	(3.11)	(5.22)	(2.22)	(0.26)	(0.36)	(0.20)
× Equity Share Prior	0.14	0.4	0.12***	0.05***	0.03	0.02
	(0.15)	(0.33)	(0.04)	(0.01)	(0.02)	(0.01)
× Chg. in UI Share	3.30**	0.63	1.14	0.18	-0.68	-0.30
	(1.37)	(2.24)	(1.44)	(0.20)	(0.48)	(0.30)
× Head Income Prior	-0.18	1.05***	-0.32***	-0.02	0.04	0.05*
	(0.20)	(0.25)	(0.12)	(0.02)	(0.04)	(0.03)
× (Head Income)^2 Prior	0.03	-0.04***	0.04***	0.00**	-0.01	-0.00
	(0.02)	(0.01)	(0.01)	(0.00)	(0.01)	(0.00)
B: Income Elasticity - Use the Family Income to Calculate Ratios						
Δ log(Head Income)	-1.26	19.15***	8.50***	1.40***	2.12***	1.74***
	(4.76)	(5.96)	(2.51)	(0.51)	(0.61)	(0.40)
× Mortgage Share Prior	-5.89**	-9.49***	-3.36**	-0.55*	-1.63***	-1.07***
	(2.80)	(3.17)	(1.43)	(0.30)	(0.46)	(0.29)
× Equity Share Prior	0.11	0.61**	0.27***	0.07***	0.04**	0.02**
	(0.11)	(0.24)	(0.09)	(0.02)	(0.02)	(0.01)
× Head Income Prior	-0.12	0.48***	-0.09	0.00	-0.00	0.01
	(0.20)	(0.18)	(0.11)	(0.02)	(0.03)	(0.02)
× (Head Income)^2 Prior	0.04**	0.02	0.04***	0.00*	-0.00	0.00
	(0.02)	(0.02)	(0.01)	(0.00)	(0.00)	(0.00)

NOTE: Annual PSID data from 1968 to 1997. Sample selection criteria and variable definitions are similar to those in Table 1.5 and Table 1.6. In Panel A, *Chg. in UI Share* is the change in the head's UI payments from $(t-1)$ to t, normalized by the head's income prior to the unemployment spell. In Panel B, both the *Mortgage Share* and *Equity Share* are divided by the total income from both the head and the wife in the family. PSID family weights are used for calculations. Standard errors are reported in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

1.6.1 Committed Consumption and Discretionary Consumption

This subsection examines how the presence of consumption commitments such as mortgages or rent affects the impact of an income shock on discretionary consumption. With adverse income changes, it is relatively harder to adjust inflexible goods, and thus it is expected that the reduction of consumption expenses concentrates on flexible ones. The PSID has detailed information on food consumption each year up to 1997, and biennially up to 2013.[22] Two major categories of food expenditures are used; one is food purchased away from home, and the other is food expenditure spent at home. The estimation equations are:

$$\Delta FoodShare_{i,t} = \beta_0 + \beta_1 \Delta log(y_{i,t}) + \beta_2 (k/y)_{i,t-1} \cdot \Delta log(y_{i,t}) + \gamma_1 Y_{i,t-1} \cdot \Delta log(y_{i,t}) + \gamma_2 X_{i,t} \cdot \Delta log(y_{i,t}) + \gamma_3 State_{s_i,t} + Year_t + \varepsilon_{i,t}, \quad (1.11)$$

$$\Delta FoodComp_{i,t} = \beta_0 + \beta_1 \Delta log(y_{i,t}) + \beta_2 (k/y)_{i,t-1} \cdot \Delta log(y_{i,t}) + \gamma_1 Y_{i,t-1} \cdot \Delta log(y_{i,t}) + \gamma_2 X_{i,t} \cdot \Delta log(y_{i,t}) + \gamma_3 State_{s_i,t} + Year_t + \varepsilon_{i,t}. \quad (1.12)$$

The sample selection criteria and construction of independent variables are similar to those in Subsection 1.4.3. $FoodShare_{i,t}$ is the ratio of food spending to family income in year t. $\Delta FoodShare_{i,t}$ is the change in the food share from year $(t-1)$ to year t. In addition to the share of food expenditure, the composition of food consumption is also studied. $FoodComp_{i,t}$ is the ratio of food away from home to food at home. $\Delta FoodComp_{i,t}$ is the change in this ratio of food composition from year $(t-1)$ to year t.

The associated estimation results are reported in Table 1.9. Panel A is for homeowners and Panel B is for renters. In both panels, a greater share of the head's income being devoted to housing consumption leads to a lower share of food consumption over family income upon the head's unemployment. The estimated coefficient for the interaction term shows that having costly adjustable consumption causes a concentration of reduction in discretionary consumption such as food when the family experiences an income loss. For instance, the change in the food share for homeowners decreases by 2.6 percentage points if the mortgage share prior to the shock increases by 10 percentage points across all the observations used in the estimation. The estimated impact is even greater for renters. The same increase in the precommitted rent share lowers the change in the food share by 6.3 points.

Column (2) in Table 1.9 demonstrates the influence of commitments on the composition of food consumption. The same rise in the precommitted share of housing costs increases the change

[22] The information on food is missing in the years 1973, 1988 and 1989.

Table 1.9: Commitments and Discretionary Consumption

(non-movers)	(1) ΔFood Share	(2) ΔFood Comp.
A: Homeowners		
Δ log(Head Income)	-0.65	0.93***
	(0.55)	(0.25)
× Mortgage Share Prior	0.79***	-0.13*
	(0.23)	(0.07)
× Equity Share Prior	-0.02*	0.01***
	(0.01)	(0.00)
× Head Income Prior	0.05***	-0.06***
	(0.02)	(0.01)
× (Head Income)^2 Prior	-0.00**	0.01***
	(0.00)	(0.00)
Obs.	2,478	2,478
Margin. Effect (+10 p.p. in Mort. Share)	-2.6 p.p.	+0.4 p.p.
B: Renters		
Δ log(Head Income)	-0.03	0.96
	(2.13)	(0.92)
× Rent Share Prior	2.06**	-0.04
	(0.85)	(0.32)
× Head Income Prior	0.30***	-0.08
	(0.11)	(0.05)
× (Head Income)^2 Prior	-0.03	0.03**
	(0.02)	(0.01)
Obs.	1,132	1,210
Margin. Effect (+10 p.p. in Rent Share)	-6.3 p.p.	+0.1 p.p.

NOTE: Annual PSID data from 1968 to 1997. The sample selection criteria and construction of independent variables are similar to those in Tables 1.5-1.7. $\Delta FoodShare_{i,t}$ in Panel A is the change in the food share from year $(t-1)$ to year t. $\Delta FoodComp_{i,t}$ in Panel B is the change in the ratio of food away from home to food at home. PSID family weights are used for calculation.
Standard errors are reported in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

in the ratio of food away from home to that at home by 0.4 percentage points for homeowners and merely 0.1 points for renters. These results imply that the added worker effect makes a wife more likely to participate in the labor force and work for more hours, while spending less time preparing food at home.

In summary, food consumption responses of homeowners and renters exhibit similar patterns. In the presence of inflexible goods, the reduction in consumption expenditures is more likely to happen in discretionary ones when a family is economically hit. The family tends to consume more at restaurants and spend less time preparing food at home.

1.6.2 Committed Consumption and Savings

This section studies how the existence of consumption commitments affects precautionary savings. When a family is heavily loaded with committed expenditures, a bigger stock of liquid assets is needed to buffer against adverse income shocks. The following equation is used to examine the impact of committed housing expenses on savings:

$$(A/y)_{i,t} = \beta_0 + \beta_1 (k/y)_{i,t} + \gamma_1 X_{i,t} + \gamma_2 State_{s_i,t} + Year_{i,t} + \epsilon_{i,t}. \tag{1.13}$$

The sample is limited to families with a wife present in the family unit, and with the head aged between 24 and 54. There was no change in the family composition. It is further limited to those with the head continuously employed in two consecutive survey years, year t and year $(t-2)$, as of year t indicated in the equation. Since the PSID only has continuous biennial data on liquid assets since 1999, the sample period is from 1999 to 2007. The data after 2007 are excluded to avoid the Great Recession period in the estimation. Dependent variables are defined in the same way as those in previous subsections. Two indicators of liquid assets are used to calculate $(A/y)_{i,t}$. One is the total amount of cash, including checking/savings accounts, money market funds, certificates of deposit, government savings bonds, and Treasury Bills. The other is the total amount of cash only in checking/savings accounts. $(A/y)_{i,t}$ is the amount of liquid assets divided by the family income in year t.

The corresponding estimation results are reported in Table 1.10. There is only weak evidence of the impact of precommitments on savings for renters. The influence is comparatively greater for homeowners. Homeowners who have a higher ratio of mortgage payments to family income proportionally hold more liquid assets, which is consistent with precautionary motives. If the precommitted mortgage share increases by 10 percentage points, the share of liquid assets rises by 3 percentage points, while the share of checking and savings relative to family income goes up by almost 4 points.

Table 1.10: Consumption Commitments and Savings

	(1) Liquid Share	(2) Chk/Sav Share	(3) Liquid Share	(4) Chk/Sav Share
Mortgage Share	0.30	0.37**		
	(0.20)	(0.17)		
Rent Share			0.06	0.02
			(0.07)	(0.12)
Obs.	3,807	8,072	479	1,047

NOTE: Biennial PSID data from 1999 to 2007. Details of sample selection are discussed in Subsection 1.6.2. *Liquid Share* is the total amount of cash in checking/savings accounts, money market funds, certificates of deposit, government savings bonds, and Treasury Bills divided by family income in year t. *Chk/Sav Share* is the amount of cash only in checking/savings accounts over family income. PSID family weights are used for calculations. Standard errors are reported in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

1.7 Further Discussion

There are several limitations to this paper. First of all, in the baseline specifications in Section 1.4, only home equity is used in the estimations regarding the added worker effect. Other types of family wealth, particularly liquid assets, are not included due to lack of data information. Chen and Stafford (2016) document that many households took on substantial mortgage commitments while holding a limited buffer stock of safe liquid assets as of 2007. Instead, some of them bought stocks to serve as a safety net without understanding the co-movement between equity and stock prices. During the housing market crash, these families had to sell stock holdings at a fire sale price to pay their mortgages and maintain commitments. I argue that even though there is likely to be an omitted-variable issue, it hardly affects the key conclusions made in previous sections, or even leads to an underestimation of the true impact of consumption commitments. One reason for this is that home equity is the dominant component of family wealth. Most families interviewed in the PSID built up limited other forms of financial resources beyond home equity, and were used to tapping into their growing equity as home prices rose. The other reason is that in Subsection 1.6.2, Table 1.10 shows the liquid-asset share is either orthogonal to the precommitted share (for renters), or positively related to it (as for homeowners). With more commitments, homeowners save more liquid assets correspondingly, which tends to reduce the sensitivity of spousal labor supply to the head's income change. Thus omitting the liquid-asset share in the estimation either hardly affects the results or understates the true coefficients.

Second, because of the selection criteria imposed in this paper, it is impossible to control the heterogeneous risk preferences. Different families may have their own risk aversion and time preferences, which affect their preferred commitment holdings. There are not sufficient observations available to include the family-fixed effect which could help to mitigate the heterogeneity problem.

Third, this paper doesn't discuss the endogenous home-ownership decision. Intuitively, people choose to rent probably because they expect their income streams not to be very stable. Greater income risks make households more cautious when they decide whether to purchase their own homes. It remains an interesting question to explore why some choose to rent while others choose to own homes, and how it would affect the results emphasized in this paper.

Finally, I assume that the spousal working hours can be freely adjusted in response to the head's unemployment shock, but in real life it may require adjustment costs to make changes in hours.

1.7.1 Controlling for Financial Status

As mentioned above, only home equity is used to account for wealth status due to the lack of financial information in the PSID prior to 1999. In this subsection, I use limited wealth information available from the PSID to construct a proxy for family financial status, and check whether the results survive new specifications with family wealth status included. The "*Event Study*" strategy is applied to perform econometric analyses. The PSID data related to family financial wealth information were recorded only in the years 1984, 1989, 1994 and biennially since 1999. Therefore, only the data from 1984, 1989 and 1994 are used to construct the indicator. The regression equation is:

$$Outcome_{i,t} = \beta_0 + \beta_1 (k/y)_{i,t-1} + \beta_2 Constrained_{i,t-1} + \gamma_1 Y_{i,t-1} + \gamma_2 X_{i,t} + \gamma_3 State_{s_i,t} + Year_t + \varepsilon_{i,t}, \quad (1.14)$$

where the sample selection criteria and variable definitions are similar to those in Subsection 1.4.3. The head needs to be continuously employed in $(t-2)$ and $(t-1)$, and to have reported unemployment in year t. The outcome variables cover all extensive and intensive margins shown in Subsection 1.4.3, with the exception of the switch from unemployment to employment. The Logit estimation fails to go through due to limited observations.

$(k/y)_{i,t-1}$ is housing expenditures divided by the head's labor income prior to the income shock. The housing spending includes mortgages, property tax, and insurance for homeowners, or rent for renters. $Constrained_{i,t-1}$ indicates whether the family hit borrowing constraints before experiencing the unexpected income loss. I do not use the value of family liquid wealth directly because of the relatively small number of observations and the measurement error issue in the PSID data. These problems may result in insignificance of the estimated coefficients. For indicative purposes, I construct the variable $Constrained_{i,t-1}$, which is set to 1 if the amount of cash kept in the checking and savings accounts was less than 1 percent of the head's income in $(t-1)$. With the specification in eqn.(1.14), I can further check whether the inclusion of liquid wealth

status affects the conclusion regarding the amplification of consumption commitments on the added worker effect (β_1). In addition, I can examine whether hitting credit constraints influences the spousal labor supply response (β_2).

Estimation results are reported in Panel A of Table 1.11. The small sample size is due to the fact that only three years of PSID data are applied to perform the analyses. First, Table 1.11.A shows that a higher precommitted share of housing costs is always associated with stronger spousal labor response, consistent with the conclusion made in Subsection 1.4.3. Second, conditional on precommitments and other factors, being liquidity constrained prior to the income shock induced the wife to work more. The statistical significance of these coefficients is not affected by the relatively small number of observations left after the selection. The evidence is consistent with the intuition that when prohibited from borrowing, the wife has a stronger incentive to enter the labor force and work more, to avoid a sharp reduction in flexible consumption.[23] From Table 1.11.A, being constrained prior increases the likelihood of becoming a new entrant to the labor force by almost 28 percentage points. It leads to 118 more hours once the wife switches from not working to working status. Alternatively, it leads to an increase of 9.7 points in the log of hours worked. For a wife already working prior to the head's income shock, being financially constrained induces the wife to work 285 more hours, or 19.3 more points in terms of the log of hours.

1.7.1.1 Alternative Constraint Indicator

In this part, I use the loan-to-value (LTV) ratio for homeowners to construct the borrowing-constraint indicator. The regression equation is similar to that in eqn.(1.14), except that the ratio of home equity to the head's income before the unemployment shock is added as an additional variable. The constraint indicator is set to 0 if the LTV ratio for a homeowner is below 80%, and set to 1 if the LTV ratio is equal to or more than 80%. In this way, I identify two distinct groups within the category of homeowners, and test whether a higher loan ratio prior to the head's income shock increases the likelihood of the secondary earner entering the labor force and providing more market labor.

Estimation results are reported in Panel B of Table 1.11. Using the alternative constraint indicator allows a bigger sample size since more years of data can be used in the estimation. Similar to Panel A, Panel B of Table 1.11 also shows that the inclusion of family wealth status hardly affects the economic and statistical significance of the key conclusions made in Section 1.4. In addition, binding constraints caused the wife to work for a longer time. Having a high LTV ratio has a strong impact on the probability of the wife becoming a new entrant to the labor force and on the

[23] Chetty and Szeidl (2007) show that the presence of liquidity constraints further amplifies the risk aversion under moderate-scale income shocks. Rossi and Trucchi (2016)'s estimation results reveal that borrowing constraints increase the intensity in men's labor supply.

Table 1.11: Borrowing Constraints and Added Worker Effect

	Wife Not Working Prior			Wife Working Prior	
	(1)	(2)	(3)	(4)	(5)
	Enter L.F.	ΔHours	ΔlogHours	ΔHours	ΔlogHours
A: Event Study					
Precommitted Share	10.81***	1.71***	1.36***	0.34*	0.19
	(3.52)	(0.53)	(0.40)	(0.20)	(0.14)
Constrained Prior	3.21***	0.12	0.10	0.29***	0.19***
	(1.15)	(0.31)	(0.23)	(0.08)	(0.05)
Head Income Prior	-0.06	0.12	0.08	0.09***	0.05**
	(0.71)	(0.17)	(0.13)	(0.03)	(0.02)
(Head Income)^2 Prior	-0.09	-0.02	-0.01	-0.00*	-0.00
	(0.08)	(0.01)	(0.01)	(0.00)	(0.00)
Obs.	118	64	64	334	334
Margin. Effect:					
(+10 p.p. in Precommitted Share)	+11.0 p.p.	+171 hrs	+13.6 log pt.	+34 hrs	+1.9 log pt.
(Being Constrained)	+27.8 p.p.	+118 hrs	+9.7 log pt.	+285 hrs	+19.3 log pt.
B: Alternative Constraint Indicator					
Mort Share Prior	1.97*	0.74	0.14	-0.19	-0.08
	(1.08)	(0.56)	(0.13)	(0.13)	(0.08)
Equity Share Prior	-0.03	-0.11***	-0.04**	0.01	0.01
	(0.04)	(0.04)	(0.02)	(0.01)	(0.00)
Constrained Prior	1.19*	0.55*	0.16	0.21**	0.20**
	(0.66)	(0.31)	(0.10)	(0.11)	(0.08)
Head Income Prior	-0.24***	0.14***	0.03***	0.04**	0.02**
	(0.07)	(0.05)	(0.01)	(0.02)	(0.01)
(Head Income)^2 Prior	0.01***	-0.01*	-0.00***	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Obs.	586	622	622	1,405	1,405
Margin. Effect:					
(+10 p.p. in Mort. Share)	+2.3 p.p	+74 hrs	+1.4 log pt.	-19 hrs	-0.8 log pt.
(Being Constrained)	+17.1 p.p.	+549 hrs	+15.5 log pt.	+213 hrs	+20.0 log pt.

NOTE: Annual PSID data from 1968 to 1997. See Section 1.7.1 for sample selection and variable definitions. *Constrained Prior* in Panel A is a dummy variable indicating whether the cash amount in checking and savings accounts is less than 1 percent of total family income prior to the unemployment spell. *Constrained Prior* in Panel B indicates whether the loan-to-value ratio was above 80 percent before the shock. PSID family weights are used for calculations. Standard errors are reported in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

hours worked by the wife. For example, being financially constrained increases the possibility of becoming a new entrant by 17 percentage points. It leads to an average of 549 more hours worked by wives who were out of the labor force prior to their heads' unemployment, and 213 more hours for wives already working beforehand.

In summary, controlling for family wealth status barely influences the estimated impact of consumption commitments on the added worker effect. This part also discovers that hitting the borrowing constraints adds another layer of motivation for a wife to enter the labor market and work longer.

1.7.2 Heterogeneous Added Worker Effects During the Life Cycle

Deaton (1986) considers a variety of evidence that sheds light on the validity of the life-cycle model of consumer behavior. Consumption changes upon income shocks should vary across different age cohorts. This subsection examines the heterogeneous spousal labor supply responses over the life cycle. It investigates whether the added worker effects differ across age groups. Table 1.12 shows the differential spousal labor supply responses during the Great Recession. It is evident that the responses vary over different age cohorts, with the oldest group reducing the labor force participation the most during this period.

Table 1.12: Precommitment Share and Pre-Equity Share by Age Category

	Precommit Share	Pre-Equity Share	LFP(2007)	LFP(2011)	ΔLFP
$24 <$ Head Age ≤ 34	0.29	1.65	0.75	0.71	-0.04
$34 <$ Head Age ≤ 44	0.30	2.46	0.75	0.75	0.00
$44 <$ Head Age ≤ 54	0.25	3.36	0.82	0.74	-0.08

NOTE: PSID data in 2007 and 2011. Details of sample selection and variable definitions are discussed in subsection 1.7.2. PSID family weights are used for calculations.

Intuitively, stronger spousal labor supply responses are expected for younger cohorts for several important reasons. First, older cohorts are more likely to have accumulated enough buffer stocks of liquid assets to insure against unexpected events, while younger families usually have limited financial resources. Second, Table 1.12 reveals that younger cohorts generally commit a higher share of income to inflexible consumption, at least during the Great Recession. Combined with limited asset holdings as discussed above, the impact of consumption commitments on the added worker effect is amplified at the early-life course stage. Third, older cohorts might have a well-established credit history and thus they could have more channels of external short-term financing. Fourth, permanent income changes have a smaller impact on the lifetime earnings as agents get older.

While the former two points are already taken into account in the baseline regressions, the latter two, the credit history and influence on lifetime wealth, are more unobservable. Their impacts are possibly reflected in the estimated coefficients for age variables. To compare different age groups, I apply similar estimation methods to those in Subsection 1.4.3. The regression equations are:

$$Outcome_{i,t} = \beta_0 + \beta_1(k/y)_{i,t-1} + \gamma_1 Y_{i,t-1} + \gamma_2 X_{i,t} + \gamma_3 State_{s_i,t} + Year_t + \varepsilon_{i,t}, \quad (1.15)$$

$$Outcome_{i,t} = \beta_0 + \beta_1 \Delta log(y_{i,t}) + \beta_2 (k/y)_{i,t-1} \cdot \Delta log(y_{i,t}) + \gamma_1 Y_{i,t-1} \cdot \Delta log(y_{i,t}) + \gamma_2 X_{i,t} \cdot \Delta log(y_{i,t}) + \gamma_3 State_{s_i,t} + Year_t + \varepsilon_{i,t}, \quad (1.16)$$

where the outcome variables are the same as in eqn.(1.9) - eqn.(1.10). The only difference between equations used in this section and those in Subsection 1.4.3 is that instead of using the head's age and head's age squared in each regression, three age categories are created and used in the estimation to identify the life-cycle influence on the added worker effect. The corresponding age groups are those aged between 24 and 34, aged between 34 and 44, and aged between 44 and 54. The key hypothesis tested is whether wives from older cohorts are less likely to get involved in the labor force or provide more market labor upon the head's unemployment.

Table 1.13: Heterogeneous Added Worker Effects Over the Life Cycle

	Wife Not Working Prior				Wife Working Prior	
	(1)	(2)	(3)	(4)	(5)	(6)
	Enter L.F.	Enter Emp.	ΔHours	Δ*log*Hours	ΔHours	Δ*log*Hours
A: Event Study						
$34 <$ Head Age ≤ 44	0.33	-1.98***	-0.19	-0.12*	0.06	0.04
	(0.43)	(0.48)	(0.18)	(0.07)	(0.05)	(0.04)
$44 <$ Head Age ≤ 54	-0.28	-2.15***	-1.07***	-0.33***	-0.13**	-0.09**
	(0.56)	(0.50)	(0.22)	(0.07)	(0.06)	(0.04)
B: Income Elasticity						
$34 <$ Head Age ≤ 44	0.47	0.34	-0.41*	-0.33***	-0.15*	-0.11**
	(0.85)	(0.38)	(0.23)	(0.08)	(0.08)	(0.06)
$44 <$ Head Age ≤ 54	0.63	2.65***	1.23***	0.26***	0.06	0.03
	(1.11)	(0.65)	(0.31)	(0.08)	(0.08)	(0.06)

NOTE: Benchmark: $24 \leq$ Head Age ≤ 34. Annual PSID data from 1968 to 1997. See Section 1.7.2 for sample selection and variable definitions. PSID family weights are used for calculations.
Standard errors are reported in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Estimation results are reported in Table 1.13. Panel A utilizes the "*Event Study*" approach while Panel B uses the "*Income Elasticity*" approach. The majority of the estimated coefficients are consistent with the theory that wives from older households are less sensitive to the head's income cuts. Some inconsistencies indeed show up though, particularly for the mid-aged group in

the case of "*Income Elasticity*." By the "*Event Study*" approach, the overall added worker effect from the mid-aged cohort is smaller than that of the youngest cohort, but greater than that of the oldest group as shown in Panel A of Table 1.13.

1.8 Conclusion

This paper helps to understand the transmission mechanism from wage shocks to spousal labor supply and how a household manages to smooth consumption. The presence of consumption commitments, such as mortgage payments and car loans, amplifies the spousal labor supply response to an unanticipated shock to the primary earner's income in the family. When husbands experience adverse income shocks, wives from families with more resources allocated to inflexible goods are more likely to enter the labor market and provide more hours regardless of the previous employment status. Moreover, the paper discovers that the impact of commitments is more accentuated in terms of the "added worker effect" (entering the labor force and becoming employed), with only a moderate "added hour effect" (working for more hours by wives already employed). It also confirms the important role played by liquidity constraints in household behavior. Finally, I emphasize the empirical evidence of heterogeneous responses over the life cycle and discuss important reasons related to this pattern. Consumption commitments matter the most for households during the early-life stage since they are more likely to face binding financial constraints at this stage.

For future research, it would be interesting to study how commitments affect overall labor responses during different phases of a business cycle. The intra-family insurance mechanism puts married couples in better shape than single-headed households. Therefore, it is worth examining the welfare improvement due to the insurance achieved within the family.

CHAPTER 2

Relocation, Intergenerational Transfers, and Extended Family Insurance

2.1 Introduction

During the Great Recession, the turmoil in labor and financial markets led the wealth and income status of many families to deteriorate substantially. In particular, adult children who had not established their own families for long might not have accumulated sufficient resources to buffer against adverse outcomes, particularly in the collapsing labor market. It is important to study how families managed to get through such financial difficulties. Although they could find many formal channels such as unemployment insurance or disability benefits to partially cover their income losses during this period, it is also interesting to see whether adult children utilized the informal channel of time and money assistance from parents to insure against temporary hardship and to smooth consumption.

We believe this is the first paper to examine the implication of intergenerational time transfer from parents to their adult children who have already established their own families and continue to reside outside their parents' homes. Through a two-generation model, we explain how parental time transfer influences and connects to children's labor supply decisions. Furthermore, when economic conditions change, children who initially lived far away from parents can opt to relocate and live closer, which facilitates time help from parents. This form of transfer can provide extended family risk sharing to counter the impact of negative income shocks experienced by children. The paper also compares time transfer with financial transfer and with coresidence, and highlights the key differences among all three in terms of the impact on children's behavior and well-being. In the end, we use the Use of Time supplemental study from the PSID to examine how relocation affects the specific forms of parental time assistance.

This paper contributes to several strands of literature related to intergenerational transfers.[1]

[1]For literature on empirical evidence and patterns of transfers, see McGarry and Schoeni (1995), Hill and Soldo (1995), Schoeni (1997), Haider and McGarry (2005), Albertini et al. (2007), and Wiemers et al. (2016).

First, it contributes to the literature on extended family insurance. Previous studies focus on non-market insurance through intergenerational money transfer and coresidence with parents. Kaplan (2012) concludes that the option for young people to move in and out of their parental home is an important insurance channel against labor market risks, allowing them to have better prospects for future earnings growth. Engelhardt et al. (2015) also investigate how extended families utilize the option of co-residing to cope with adverse economic conditions. Matsudaira (2016) points out that the economic downturn coincided with young adults choosing to remain at home, or moving back in with their parents. Coate et al. (2017) discover that young adults living close to their parents experienced stronger earnings recoveries after a job displacement than those living farther away. They also find some evidence that parents' social networks helped adult children to find local jobs.[23] Compared with previous studies on informal family insurance through shared living, our paper specifically examines the implication of intergenerational time transfer, beyond the choice of living with parents as an insurance channel. Adult children can adjust their geographical distance from parents to facilitate time reciprocity, and benefit from it.

Second, our paper supplements the literature studying the impact of parental time and money transfers on children's labor supply. Pabilonia (2001) and Wolff (2006) study the association between parental cash transfer and youth employment. Other research on the family network emphasizes the positive effect of grandparenting on labor supply. Zamarro (2011) and Posadas and Vidal-Fernandez (2013) also find grandparental childcare significantly increases mothers' labor force participation. Third, this paper contributes to research studying factors that influence resource transfers between parents and children, such as income, wealth, health status and family relationship (Altonji et al., 1996; Hayhoe and Stevenson, 2007; Kim et al., 2012).

The paper is constructed as follows. Section 2.2 introduces key elements of the PSID data used in the paper, and provides indicative statistics. Section 2.3 shows how changes in adult children's income and parental wealth drove the pattern of migration, and the association between relocation and intergenerational transfers. Section 2.4 sets up a two-generation model which is used in Section 2.5 to explain how time assistance from parents reshapes the labor supply and welfare of adult children. Section 2.5 also compares different forms of transfers and emphasizes the similarities and differences among them. Section 2.6 provides further evidence of the forms of parental time assistance. Section 2.7 concludes the paper.

[2]Other similar literature on living arrangements of adult children includes Beekink et al. (1991), Whittington and Peters (1996), Mulder and Clark (2002). Wiemers (2014) finds that individuals who become unemployed are three times more likely to move into shared living arrangements with parents.

[3]For work on other mechanisms of informal family insurance, see Victorio (2002), Attanasio et al. (2005), and Dalton and LaFave (2016).

2.2 Data and Descriptive Statistics

2.2.1 PSID Data

This paper utilizes data from the Panel Study of Income Dynamics (PSID), which is the longest running national household panel survey in the United States. It has collected data annually from 1968 to 1997, and every other year thereafter. In addition to the data from the main interviews, PSID also contains information about transfers of time and money from one generation to another conducted in 1988 and 2013. The 2013 Family Rosters and Transfers data are from an additional PSID module funded by the National Institute on Aging. This module plays an important role in the analyses performed in our paper. Further details of the 2013 Rosters and Transfers data are provided in the following subsection. PSID main interviews provide various types of information, indicating economic status, educational attainment and other demographic characteristics of each head of the family, wife if any, and other family members.

PSID geospatial restricted data are also utilized to construct dummy variables that indicate the actual distance between children and parents who were heads or wives. It is well established in the literature that time transfer across different generations is significantly affected by the distance between them. The goal is to see the extent to which distance is shaped in the context of economic shocks. The farther away from parents, the less time transfer children receive from parents. The PSID geospatial data contain information on county FIPS codes and five-digit ZIP codes, in addition to the public version of residence state codes. In this paper, the county information is the primary source for constructing the distance indicator between parents and their adult children during the Great Recession period.[4]

2.2.2 2013 Family Rosters and Transfers

The 2013 Rosters and Transfers supplemental data record time and money transfers to and from parents, and also time and money given to and from children. It includes two files, the family-level file and parent/child file. The family-level file contains transfer information for heads and applicable wives at the family level, while the parent/child file contains roster and transfer information for each specific unit of parents or children associated with the heads and wives. Both files capture short-term transfers in 2012 and long-term (since the age of 18) transfers, at the family level and the individual parent or child level. These transfers were recorded for related individuals outside the immediate family and who are not active members of the PSID's genealogical design (Wiemers

[4]The plausible reason to use county-level geospatial information, instead of a more disaggregated measure, is that parents in the same county but still in a separate residence from their adult children can still commute to provide time assistance.

et al., 2016). In this way, the study expands the usual scope of human subjects studied in the PSID by collecting information from all living children and parents of PSID heads and wives. For each biological or adoptive child of heads, and of applicable wives, the roster module asked about age, health status, work status, marital status, educational attainment and income categories.

For the short-term transfers, the 2013 transfers module asked respondents, as heads or wives, to report money given to or received from parents and children in the last year, and also time spent helping or being helped by parents and children. For the long-term transfers, respondents were asked about financial support from parents to pay for school, home purchases and financial help for other expenses since the age of 18. Financial support provided to children to pay for school, home purchases or other expenses was also recorded. For this paper, we only use the child-unit information from the parent/child file. The family-level file contains family interview numbers which can be linked to the PSID family-level main interview conducted in the same year. The parent/child file includes 1968 interview numbers and person numbers for heads and wives, and also 2013 family interview numbers. These identifiers allow a merger with data from other PSID main interviews and supplements. Moreover, this supplemental study also recorded 1968 interview numbers and person numbers of parents and children of families interviewed in the PSID, and thus information for children of PSID families can be tracked if children themselves were also PSID participants.

A summary of statistics for key demographic variables is listed in Table 2.1. Among 11,275 child records, 6,719 have been in the PSID study before. We further limit the adult-child sample to those aged between 25 and 45, and with parents between 43 and 70 years old. This reduces the sample size to 3,671. "Child" in Table 2.1 refers to the child unit identified in the 2013 Rosters and Transfers study. Parents as heads in the 2013 PSID main interview were 59 years old on average, while the average age of parents as wives in the 2013 PSID was close to 58.[5] The average age of children in the 2013 Rosters and Transfers was around 32. The health status of heads was slightly worse than that of wives overall, while children were substantially healthier than their parents. Half of the heads were white, while almost 70 percent of the heads were male. The average number of children under 18 years old in the family unit was 0.17. On average, adult children interviewed in the 2013 Rosters and Transfers had approximately one dependent child. 40 percent of adult children earned more than $50,000 in the 2013 Rosters and Transfers.

2.2.3 Descriptive Statistics for Intergenerational Transfers

This subsection provides descriptive empirical evidence of the prevalence and extent of intergenerational time and money transfers using the PSID supplemental study discussed in the previous

[5]The sample includes families with married couples, as well as those with a single parent as the head.

Table 2.1: Summary of Demographic Characteristics Using 2013 Rosters and Transfers

VARIABLES	MEAN	STD. DEV.
Head age	59.57	6.04
Wife age	58.44	5.66
Child age	32.76	5.56
Head health (1-excellent, 5-poor)	2.73	1.12
Wife health (1-excellent, 5-poor)	2.57	1.02
Child health (1-excellent, 5-poor)	2.07	1.05
Head is White	0.56	
Head is male	0.68	
Head attended college	0.57	
Head obtained a college degree or above	0.38	
Whether head has wife/"wife"	0.58	
Number of children under 18 in FU	0.17	0.60
Number of kids living with adult "child"	1.31	1.38
Income and Wealth		
Family wealth includ. home equity (in $1,000)	445.24	1319.19
Family wealth exclud. home equity (in $1,000)	333.07	1209.77
Total inc. from all family members (in $1,000)	87.53	128.27
Total inc. from head and applicable wife ($)	81.90	127.67
Child inc. above 50K	0.40	

NOTE: The sample is limited to families with "child" records in the 2013 Rosters and Transfers study. It is further restricted to families with heads and wives (if applicable) between 43 and 70 years old, and children between 25 and 45 years old in the 2013 survey. Individual weights are used for child records and family weights are used for head and wife records.

section. Intergenerational transfers can have important implications when children make location decisions as they establish their own residence. Money transfer allows adult children to have more choices about the location of their workplace, while time transfer is more dependent on close proximity to their parents, forgoing distant job opportunities. During the recession, adults were faced with more uncertainties in the labor market, and worse job opportunities overall. They were more likely to take advantage of opportunities to move back or closer to their parental families. At plausible wage rates, the value of time transfer to adult children can match that of money transfer. The option of living closer also has important implications for adult children's consumption, labor supply and savings.

Table 2.2: Facts about Intergenerational Time and Money Transfers

A. Parents (to all children with records)	
Whether hours helping any child	0.57
Whether hours helped by any child	0.35
Whether money given to any child	0.47
Whether money received from any child	0.17
Total hours helping all children (if hours>0)	580
Total hours helped by all children (if hours>0)	417
Total money given to all children (in $, if money>100)	$5,122
Total money received from all children (in $, if money>100)	$1,105
B. Child	
Whether hours helping this child	0.39
Whether hours helped by this child	0.24
Whether money given to this child	0.35
Whether money received from this child	0.09
Total hours helping this child (if hours>0)	331
Total hours helped by this child (if hours>0)	217
Total money given to this child (in $, if money>100)	$2,274
Total money received from this child (in $, if money>100)	$676

NOTE: The sample is the same as in Table 2.1.

From Panel A of Table 2.2, 57 percent of parents in our sample spent a positive amount of time helping their adult children, and 35 percent of these families were helped by at least one of their adult children. This confirms the evidence in Cao and Stafford (2016a) that time transfer is reciprocal, but moves down the generations. For families giving time help to the next generation, on average they gave 580 hours, while for those receiving time help from their children, they received an average of 417 hours. As for financial transfer, it is relatively more one-sided. 47 percent of parental families provided financial assistance to the next generation, but only 17 percent received money. Conditional on money gifts greater than $100, families transferred an average of $5,122

to adult children, while on average they were given $1,105.[6] Panel B of Table 2.2 shows similar patterns, when the statistics are for the average child unit selected from the 2013 Rosters and Transfers as in Table 2.1. There were cases of two-sided transfers within the year (not reported in Table 2.2). 17 percent of children both received from and provided time assistance to their parents, while 5 percent of children both received money from and gave money to parents.

2.3 Relocation and Intergenerational Transfers

2.3.1 Migration During the Great Recession

This subsection provides empirical evidence of inter-state and within-state migration. Table 2.3 reports inter-state and intra-state relocations. "Parent" refers to a family unit which participated in the 2013 Rosters and Transfers survey, and "Child" refers to a child unit as identified in the same study. From 2007 to 2013, 5.7 percent of parental family units moved across states, while 14.7 percent of their children who already established their own family units prior to 2007 moved across states. During the same period, a greater share of families and children moved within the same state, relative to the inter-state migration. While 20 percent of parental families relocated within the same state (having moved to a different zip-code area), more than twice as many of their adult children who had already left home before 2007 migrated within the state. In total, more than half of the children are identified as having moved during this period.

Table 2.3 also reports the migration pattern for children, relative to the location of their parents.[7] From 2007 to 2013, almost 70 percent of child units started and stayed in the same state as their parents. Nearly 7 percent of children, initially living in a different state from their parents, moved back to their parents' state by the end of this period. A similar percentage of children did the opposite, and moved away from their parents. From Table 2.3, it can be inferred that 18.6 percent of the adult children in the sample started and stayed away from parents in this period, and therefore nearly one third of those initially living in a different state moved back to their parents' state by 2013. Among the 7 percent of children who moved back to the parents' state, only 5.7 percent of them (0.4 percent of the sample) moved to the state of their parents while reporting that they "neither own nor rent" a home. If the county code is used to construct a distance indicator, 10.4% of the children who initially lived in a different county from their parents during this same period moved back to the parents' county, and only 11 percent of them (1.2 percent in the sample) moved

[6] Excluding transfers of less than $100 was designed to screen out of small presents from birthdays or holidays.

[7] The geographic proximity is defined between the PSID family and their child record reported in the 2013 Rosters and Transfers data. An adult child is categorized as not moving back if the child moved to the residence county of the spouse's parents. Therefore, children's migration relative to their parents' location shown in Table 2.3 possibly underestimates the actual amount of movement by adult children to facilitate assistance from the extended family.

Table 2.3: Migration During the Great Recession

(%)	2007-09	2009-11	2011-13	2007-13
Move across states				
Parent (head or wife)	2.5	2.6	2.9	5.7
Child	8.5	8.2	8.1	14.7
Move within the same state[1]				
Parent (head or wife)	9.5	9.1	10.9	20.0
Child	29.4	30.5	26.9	45.2
Child stays in the same state as parents'	70.9	70.5	70.6	67.9
Child moves to parents' state	3.8	3.5	4.0	6.9
Child neither owns nor rents	0.7	0.7	0.5	0.4
Child moves away from parents' state	3.4	4.1	4.1	6.6

[1] Migration within the state is identified using PSID confidential geospatial information on zip codes.

NOTE: The sample is limited to children who had already established their own families as of 2007. Adult children were aged between 25 and 45, and parents between 43 and 70 years old in the 2013 survey. Family weights and individual weights are used for calculations.

to coreside with their parents. Therefore, many children moved closer to their parents, but not because they could share a dwelling unit with the parents and save money in that way. In summary, despite the moderate percentage of children migrating, there remain meaningful frontiers to be examined.

2.3.2 Factors Driving Relocation Patterns

This subsection investigates whether exogenous movements in the incomes of parents and adult children, or parental wealth prior to the recession influenced children's location decisions. Table 2.4 shows the migration pattern given different income changes of adult children and parents. It shows that adverse changes in economic status possibly activated the relocation. From Table 2.4, larger negative earnings shocks to children apparently made them more inclined to migrate and move closer to their parents' county of residence. The impact of parental income changes is less clear. Nevertheless, conditional on children hit by a large income loss (greater than one third), greater income cuts experienced by their parents did induce the children to move back to their parents' county more often. Table 2.4 also suggests a two-way attraction: if both parents and adult children faced troubles, they were more likely to resort to proximity for mutual help.

Table 2.4: Migration Pattern Conditional on Income Changes (%)

Child's income change (2006-2012)	Parents' income change (2006-2012)			
	All	Positive	Negative but less than 1/3 decline	Negative and at least 1/3 decline
Positive	17.3	19.2	17.7	14.9
Negative but less than 1/3 decline	19.8	20.6	22.0	21.8
Negative and at least 1/3 decline	28.8	16.3	30.2	37.6

NOTE: The percentage of children moving to their parents' county. The sample is limited to children initially having established their own families in a different county from their parents' in 2007. Adult children were aged between 25 and 45, and parents between 43 and 70 years old in the 2013 survey. The move-back indicator is 1 if the child moved back to the parents' county and still maintained an independent residence in 2013.

Table 2.5 reports related Probit estimation results, with the regression equation as follows:

$$Probit(Prob_{i,t}^{c,\textit{move back}}) = \beta_0 + \beta_1 \Delta log(y_{i,t}^c) + \beta_2 \Delta log(y_{i,t}^p) + \beta_3 \Delta log(a_{i,t}^c) + \beta_4 \Delta log(a_{i,t}^p) + \beta_5 log(a_{i,t-1}^c) + \beta_6 log(a_{i,t-1}^p) + \beta_7 own_{i,t-1}^c + \gamma_1 X_{i,t} + \gamma_2 State_{s_i,t} + Year_t + \varepsilon_{i,t}. \quad (2.1)$$

The outcome variable is whether an adult child initially living in a different county from their parents' moved to the parents' county. $\Delta log(y_{i,t}^c)$ and $\Delta log(y_{i,t}^p)$ are log changes in the child's and parents' incomes from year $(t-1)$ to t. $\Delta log(a_{i,t}^c)$ and $\Delta log(a_{i,t}^p)$ are log changes in their wealth respectively. $log(a_{i,t-1}^c)$ and $log(a_{i,t-1}^p)$ are logs of their total wealth prior to their income changes. $own_{i,t-1}^c$ indicates whether an adult child owned a home. $X_{i,t}$ is a set of demographic variables for both the adult child and the parents, including age, gender, race, marital status, and the number of kids the adult child has. $State_{s_i,t}$ includes the state-fixed effect and local economic indicators. $Year_t$ is the year-fixed effect. Table 2.5 confirms that income changes of adult children drove the migration pattern.

These facts show that during the recession, adult children used spatial closeness to facilitate assistance from their parents, therefore benefiting from risk sharing in the extended family. On one hand, about 10 percent of adult children moved back to their parents' county and chose to reside within the same dwelling unit to save rent. On the other hand, the majority of movers relocated possibly to make time assistance from parents more accessible, as emphasized in our paper. From Table 2.5, children's relocation decisions are significantly associated with the parental wealth. Limited wealth mitigates parents' ability to provide financial support to their children when economic conditions deteriorate, and leads to a higher possibility of moving back to the parents'

Table 2.5: Estimation Results of the Impact of Income Changes on Migration

Dependent Variable: Whether Moving Back to Parents' County		
Independent Variables	(1)	(2)
%ΔChild's Income	-0.275***	
	(0.072)	
%ΔChild's Wage		-0.163***
		(0.050)
%ΔParental Income	0.024	0.022
	(0.086)	(0.087)
%ΔChild's Wealth	-0.022	-0.029
	(0.032)	(0.032)
%ΔParental Wealth	-0.076*	-0.082*
	(0.044)	(0.044)
Prior ln(Child's Wealth)	-0.005	-0.002
	(0.027)	(0.027)
Prior ln(Parental Wealth)	-0.059**	-0.062**
	(0.023)	(0.023)
Prior Wtr. Child Own Home	-0.339***	-0.300***
	(0.109)	(0.110)
Child Male	0.009	0.005
	(0.084)	(0.084)
Child Married	-0.438***	-0.502***
	(0.097)	(0.095)
Child's Number of Kids	0.118***	0.127***
	(0.035)	(0.035)
Parents Married	-0.193**	-0.193**
	(0.096)	(0.096)
Obs.	2,248	2,248
R^2	0.116	0.113

NOTE: The sample is the same as that in Table 2.4. Other controls include demographic variables for the child and parents, state- and year-fixed effects. PSID family weights are used for calculations.
Standard errors are reported in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

county.

Table 2.5 also reveals that if children were already homeowners prior to the recession, it substantially reduced their possibility of moving back to the parents' county. The gender of the adult child is hardly associated with the decision to move closer to parents. Nevertheless, both parents and child being married reduce the probability of moving, while the adult child having more kids increases this likelihood. It sheds light on the key motivation for adult children to move back to their parents' county, which is probably linked to parental assistance provided for child care.

2.3.3 Linking Relocation with Transfers

Cao and Stafford (2016a) examine factors affecting the probability and the level of intergenerational transfers, using the cross-sectional data from the 2013 survey. They find that parental income and wealth are positively associated with the money transfer to children, but do not play a significant role in the time transfer. Children earning more require less financial support from parents, and provide more financial help to their parents instead. This subsection examines how decisions about whether to move back to the parents' county affect time and money transfers from parents to their adult children. Children living far away from their parents know that the distance from their parents will affect both the financial and time assistance they receive from them. Therefore, adult children will take this into consideration when they make location decisions.

Table 2.6 shows transfer flows from parents to children who initially established residence in a different county from their parents'. Among children who chose to stay in their home residence county, 36 percent of them received financial support from their parents in 2012, and on average they were given around $1,000 by parents. For those who chose to relocate and move back to their parents' county, 40 percent were given money, with an average amount of $860. Generally speaking, the probability and amount of parental money transfer are not strongly affected by the distance between parents and their children. The difference in time transfer between movers and non-movers is more accentuated as shown in Table 2.6. Only 33 percent of children who didn't move back to their parents' county received time assistance, with an average of 34 hours. In contrast, for those moving back to their parents' county, almost 54 percent received time help, and on average these children received 132 hours from their parents.

Table 2.7 shows the estimated impact of moving back to the parents' county on the probability and amount of parental time and money transfers. From the full sample as shown in Table 2.6, closer proximity between adult children and their parents significantly increases the likelihood of receiving time assistance and also the amount of time help, while its influence on money transfer is statistically insignificant. I further limit the sample conditional on the gender of adult children, and the marital status of their parents. Male children are more likely to receive time assistance

Table 2.6: Transfer Flows Conditional on Relocation Decisions

	Prob. money, amount	Prob. time, amount
Move back	40.8%, $880.0	53.6%, 131.9 hours
No move back	36.5%, $995.8	29.9%, 34.2 hours

NOTE: The sample is limited to children who initially established homes in a different county from their parents' in 2007. Adult children were aged between 25 and 45, and parents between 43 and 70 years old in the 2013 survey. The move-back indicator is 1 if the child moved back to parents' county and still maintained an independent residence in 2013.

when they choose to move closer to the parents. Nevertheless, the amount received is smaller than that given to female children, according to the estimation results. Married parents give modestly more time assistance to their adult children if they relocate back to the parents' county.

Table 2.7: The Impact of Relocation on Transfer Flows

Explanatory variable:	Prob. money	Money amount	Prob. time	Time amount
Move back	*Probit*	*Tobit*	*Probit*	*Tobit*
Full sample	0.11	234	0.55***	269***
	(0.15)	(1,243)	(0.15)	(87)
Sub-sample: male child	0.06	-737	0.70***	197***
	(0.27)	(3796)	(0.27)	(72)
Sub-sample: female child	0.13	81	0.55***	328**
	(0.18)	(605)	(0.18)	(132)
Sub-sample: married parents	-0.04	-1446	0.55***	299**
	(0.21)	(2319)	(0.21)	(146)

NOTE: The sample is limited to children who initially established homes in a different county from their parents' in 2007. Adult children were aged between 25 and 45, and parents between 43 and 70 years old in the 2013 survey. The move-back indicator is 1 if the child moved back to the parents' county and still maintained an independent residence in 2013.

From the discussion above, relocation is related to the composition of intergenerational transfers, notably time assistance for adult children who move nearby. When children make migration decisions, they will take this into account and utilize proximity to facilitate time-based insurance against income shocks. Parental time assistance could potentially induce a parallel outward shift in the time and money budget constraints of adult children. In this way, they are able to work more in the new location with more time freed up. It becomes feasible for children to make consumption decisions outside their original budget sets, and they can both increase the hours to work to be able to purchase more consumption and also enjoy more leisure. Section 2.4 sets up a two-generation model to give more details about the implication of time transfer, particularly its impact on adult children's labor supply.

2.4 Theory

Section 2.4 constructs a simple two-generation model to illustrate how a typical child makes the relocation decision to take advantage of parents' help in the face of different income opportunities, both away from and close to the parental home. In Section 2.3, we already see that many adults rely on their parents to provide assistance, and it is more convenient for them to receive time transfer from parents when living closer to parents. Adult children who initially lived away from parental homes have three options. First, they can choose to move in with parents or parents-in-law, which is the coresidence option discussed in Kaplan (2012). Second, they can opt to move closer to parents, but still maintain a separate residence. Third, they can stay where they are, if the income opportunity away from parental home is good enough to compensate for the inability to receive time assistance from parents, and if parents have sufficient financial resources to make a cash transfer.

Accordingly, there is financial gain from moving in with parents, such as saving rent and related utility expenses. However, there is a utility loss associated with living with parents. These elements generate three zones. Zone 1 represents the income range which makes an adult child prefer living away from parents. Zone 2 represents the income range that induces the child to move closer to parents to take advantage of time transfer, but still maintain an independent residence. Zone 3 is where the adult child moves back to live with the parents and to save living costs associated with having an independent residence. The main theme of this paper is the nature of the choice of Zone 2, given that the other two have been extensively studied in existing literature. Details of the model are provided below.

2.4.1 Model Setup

The two-generation model in this paper is static, with only one period. It incorporates both time and money transfers in the extended family. A child's period utility function is:

$$U^k = \frac{(\overline{c}^k)^{1-\gamma}}{(1-\gamma)} + \theta \cdot \mathbf{1}\{r \neq 0\}, \tag{2.2}$$

where $\overline{c}^k = \left[(1-\alpha_1)(c^k - z^k)^{1-\rho} + \alpha_1 (q^k)^{1-\rho}\right]^{\frac{1}{1-\rho}}$. $(c^k - z^k)$ is the consumption of the final market good for an adult child, and q^k is the consumption of a non-market good.[8] r indicates the geographical closeness to parents. It takes three values: "0" means the adult child coresides with parents, "1" means the child lives close to parents so that he or she is able to receive time transfer from parents, and "2" means the child lives far away so that it becomes infeasible to obtain

[8] In this paper, we assume that adult children still make their own independent consumption decisions, and the only benefit of coresiding with parents is saving on rent or mortgage payments.

time assistance from parents. θ is the disutility of living with parents (or utility gain from living independently). The home good q^k consumed by the adult child is produced by combining z^k, the intermediate market good, and time λ^k:

$$q^k = \left[\alpha_2 (z^k)^{1-\phi_1} + \alpha_3 (\lambda^k)^{1-\phi_1}\right]^{\frac{1}{1-\phi_1}}. \tag{2.3}$$

The time input in the production of the home good, λ^k, includes both the time spent by the child and the time given by parents:

$$\lambda^k = 1 - h^k + \zeta \mu^\tau \cdot \mathbf{1}\{r \neq 2\}. \tag{2.4}$$

In eqn.(2.4), h^k is the time spent working by the child, and μ is the time help received from parents. When $r = 0$ or 1, the child lives close enough to the parents to be able to receive time transfers from them. When $r = 2$, the child lives far away from the parents and cannot receive time assistance from them. Hence, the parental time help is seen as adding more hours to the daily time budget. The total market-good expenditure c^k is constrained by income earned in that period, and money assistance from parents, excluding housing and moving expenses: $c^k = T + w^k h^k - \chi \cdot \mathbf{1}\{r \neq 0\} - F \cdot \mathbf{1}\{r \neq r_{-1}\}$, where T is the financial support from parents. χ is housing costs such as rent the child needs to pay if choosing to live independently ($r \neq 0$), and F is relocation costs if the child chooses to move to a different place from the previous period.

We assume one-sided altruism, where only parents are altruistic toward their children. Parents' preference is defined in the function below:

$$V^p = U^p + \eta U^k, \tag{2.5}$$

$$U^p = \frac{(\overline{c}^p)^{1-\gamma}}{(1-\gamma)}. \tag{2.6}$$

The utility of parents, V^p, is composed of two parts. The first component is the utility from the consumption bundle of parents themselves (U^p), and the second is the child's utility (U^k). η measures the degree of parental altruism toward the next generation. In eqn.(2.6), $\overline{c}^p$ is a combination of consumption of a final market good ($c^p - z^p$) and a home-produced good (q^p), where q^p incorporates both market-good input and time input:

$$\overline{c}^p = \left[(1-\alpha_1)(c^p - z^p)^{1-\rho} + \alpha_1 (q^p)^{1-\rho}\right]^{\frac{1}{1-\rho}}, \tag{2.7}$$

$$q^p = \left[\alpha_4 (z^p)^{1-\phi_2} + \alpha_5 (\lambda^p)^{1-\phi_2}\right]^{\frac{1}{1-\phi_2}}. \tag{2.8}$$

The time input (λ^p) is equal to $(1 - h^p - \mu)$. h^p is the time optimally chosen by parents to work,

and μ is time assistance given to children. Total expenditure on the market good (c^p) is constrained by ($a + w^p h^p - T - \chi$). a is assets accumulated by parents, and $w^p h^p$ is labor income earned by parents in that period. Parents can choose to make a financial transfer to their child. Both the time transfer (μ) and money transfer (T) are constrained to be non-negative.

2.4.2 Timing of the Game

The timing of the game is similar to that in Kaplan (2012). The reason to specify the timing scheme is that the simultaneous-move version contains multiple Nash equilibria (Kaplan, 2012; Fahle, 2015). The scheme also follows what normally takes place in real life. In Stage 0, agents enter the current period with $\{w^p, a\}$, and wage offers $\{w^k\}$ are revealed for the child. In Stage 1, the child makes the location decision about whether to live with ($r = 0$), move close to ($r = 1$) or far away from parents ($r = 2$). In Stage 2, the parents, knowing the location and the wage rate of their child, choose time and money transfers to give to the child, and also optimally choose the consumption and labor supply. In Stage 3, the adult child decides his or her labor supply, and makes consumption decisions. The timing of the game is also shown in Table B.1 in the appendix. The allocation needs to satisfy the child's budget constraint, the parental budget constraint, and nonnegative constraints of labor supply, time and money transfers.

2.5 The Implications of Intergenerational Transfers

2.5.1 Calibration

There are 12 parameters in the model laid out in Section 2.4, $\{\eta, \xi, \tau, \gamma, \rho, \phi_1, \phi_2, \alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \theta, \chi, F\}$. η measures the altruistic preference of parents toward their children. Soares (2015) sets this parameter at 0.5, and we use the same value. $\{\xi, \tau\}$ govern the efficiency of parental time transfer. If both numbers are equal to 1, it means one unit of time assistance is equivalent to one unit of the child's time. Here we set ξ equal to 0.85, to reflect the fact that on average time assistance provided by parents is not as efficient as the hours spent by the adult child himself or herself. τ is set to 0.8 to account for the fact that the initial time help is likely to be more valuable to the child, and the return to time assistance decreases as the amount of time transfer increases. γ is the risk aversion of both parents and children, and as commonly used in the literature, it is set to 4. α_1 is the share of home-good consumption. $\{\alpha_2, \alpha_3, \alpha_4, \alpha_5\}$ are the corresponding weights of intermediate market-good input and time input for children and parents. $\{\phi_1, \phi_2\}$ are the corresponding elasticities of substitution. χ is set to 0.75 to match the median yearly rent worth \$7,500. F is set to 0.15, which implies that moving costs are slightly more than two months of

rent. θ is chosen so that the share of adult children moving to live with their parents is around 5 percent.

Without loss of generality, α_2 is set to 1. $\{\rho, \alpha_1, \alpha_3, \phi_1\}$ are calibrated to match the labor supply distribution of adult children and the share of final market-good consumption ($c^k - z^k$) over total market-good expenditure (c^k). ρ is calibrated to be 0.6, and the share of home-good consumption, α_1, is 0.4. α_3 is 8, and the elasticity between time and market-good input, ϕ_1, is calibrated to be 0.5. $\{\alpha_4, \alpha_5, \phi_2\}$ are calibrated to match the labor supply distribution of parents in the PSID. Their values are 0.7, 6 and 0.6, respectively.

2.5.2 How Do Transfers Affect Adult Children?

2.5.2.1 Staying Away vs. Moving Closer

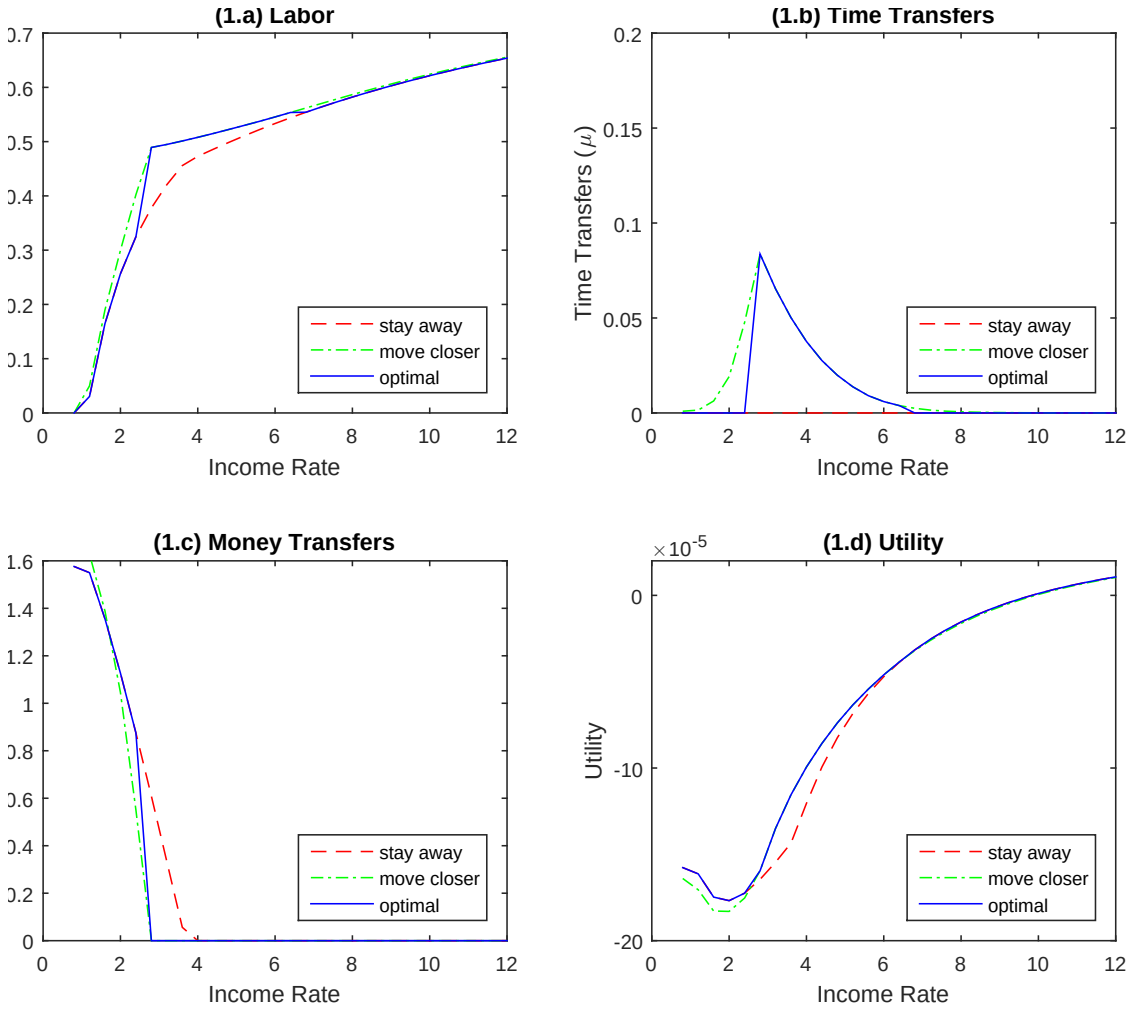
This subsection examines the implication of time transfer, and compares time transfer with other forms of intergenerational transfers. Figure 2.1 shows how the possibility of time transfer reshapes the labor supply of children, and parental financial support. The typical yearly income for parents is set at \$30,000 and their initial wealth is set to the median of the distribution at \$8,000.[9] The "stay-away" line in each figure is for the case in which an adult child stays away from his or her parents, and thus is unable to receive time assistance. The "move-closer" line is for the case in which an adult child moves close enough to his or her parents to be able to receive parental time help, but still lives in a separate residence. The "optimal" line is the optimal decision when the child's utility is maximized given the options to stay away or move closer. The income on the x-axis in each graph is the yearly income earned in units of \$10,000 if the agent chooses to work 40 percent of his/her discretionary time.

From Figure 2.1.a and 2.1.d, it is clear that the relationship between time transfer and a child's income level is not monotone. On one hand, the marginal benefit of any form of parental help is high when the child's income is relatively low, and vice versa. When the child has a high-paying job, parents have less incentive to provide any type of help. On the other hand, the opportunity cost of time transfer is the foregone earnings from working and home-produced goods. When the child's wage rate is low compared with parents', it is inefficient to directly provide time assistance and parents prefer working themselves and giving money instead. These two factors drive the non-monotonicity, and time assistance is more prevalent for those with mid-range incomes.

When the parents' typical yearly income is set at \$30,000, time transfer is particularly helpful for adult children whose income is between \$20,000 and \$60,000. Within this range, parents

[9] Appendix B.2 discusses a case with a higher parental wage rate. A typical yearly income is the yearly wage rate in units of \$10,000 multiplied by 0.4. 0.4 indicates that the agent chooses to work 40 percent of his/her discretionary time or approximately 2,000 hours in a given year.

Figure 2.1: Comparisons between Zone 2 (Move Closer) and Zone 3 (Stay Distant)



NOTE: The red line is for the case in which an adult child chooses to stay away from the location of the parents' residence; the green line is for the case in which an adult child opts to move closer to the parents but still maintains a separate residence; the blue line is the optimal decision when the child's utility is maximized given the options to stay away or move closer. The income on the x-axis is the yearly income earned in units of $10,000 if the agent chooses to work 40 percent of his/her discretionary time.

would prefer to give more time assistance so that their children could work more hours, instead of providing more financial assistance. Figures 2.1.b and 2.1.c reveal the key differences between time and money transfers. Time transfer is non-monotone with respect to a child's income. In contrast, money transfer is always monotonically related to the child's income due to the negative income effect.

Another important difference is associated with how these two types of transfers affect the elasticity of labor supply. Money transfer usually raises the elasticity of labor supply with respect to a child's wage rate. Greater elasticity caused by financial transfer is mostly due to the positive income effect. However, the impact of time transfer on the labor supply elasticity depends on the specific wage rate of a child. When the child's income is relatively low, the availability of time transfer makes the labor supply more elastic. Parents have more incentive to directly provide money assistance, and the income effect dominates in this case. However, when the child's income potential is relatively higher, the possibility of parental time help lowers the labor supply elasticity. This is due to the fact that with higher income levels of the child, parents prefer to provide time assistance, rather than money. In this case, the child can benefit more if he/she works for a longer period of time.

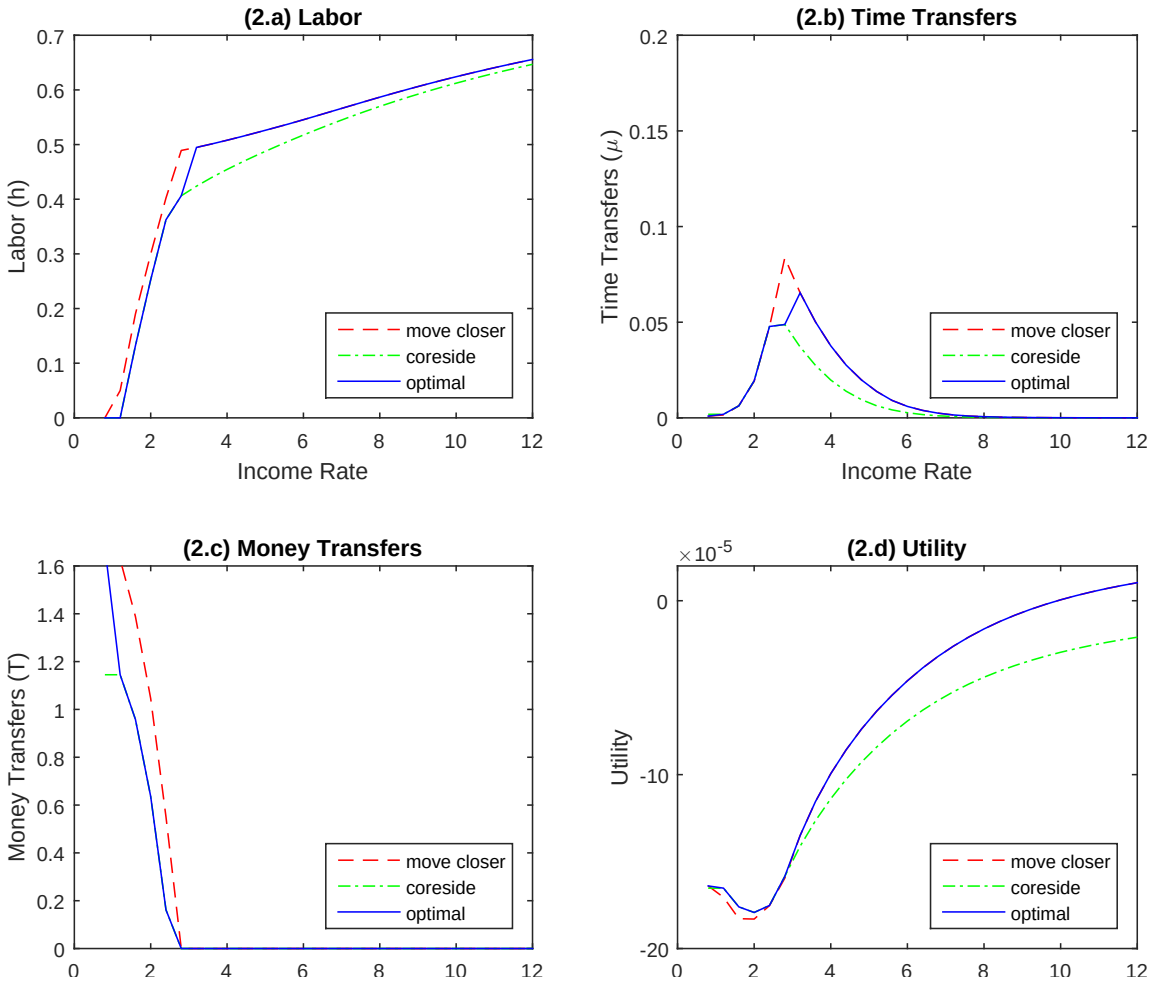
Figure 2.1.d shows the impact of the option to move closer to parents and receive time help on the child's utility. Although moving closer to the parents' place leads to a higher chance of receiving time assistance (Figure 2.1.b), the benefit needs to outweigh the moving costs (F) for an adult child to voluntarily relocate. The availability of moving closer to parents increases the utility of the adult child with a typical income ranging from \$20,000 and \$60,000, which overlaps with the area in which parents provide the most time help. This establishes that time transfer can boost children's consumption and provide insurance in the extended family like other forms of intergenerational transfers.

2.5.2.2 Moving Closer vs. Coresidence

Figure 2.2 compares the option of moving closer to parents with that of moving to coreside with parents. In the model, the extra financial gain of shared living is rent saved (χ), but coresidence is associated with a utility penalty (θ). In addition, coresidence means less financial and time assistance, compared with the option of moving closer (Figure 2.2.b and 2.2.c). Therefore, the benefit from living with parents needs to outweigh the utility loss for the adult child to choose shared living. Figure 2.2.a and 2.2.d reveal important differences between coresidence and time transfer. Parental time assistance mostly benefits adult children with mid-range incomes. In contrast, shared living with parents generally benefits children with low income levels. This is mainly because with fixed costs of a separate residence (χ), the saving from not paying rent is particularly helpful for low-income earners. Accordingly, coresidence increases the income elasticity of labor supply for

adult children. This is consistent with Kaplan (2012), which demonstrates that the option to move in and out of the parental home facilitates the pursuit of jobs with the potential for high earnings growth and leads to greater labor elasticity.

Figure 2.2: Comparisons between Zone 2 (Move Closer) and Zone 1 (Coreside)



NOTE: The red line is for the case in which an adult child chooses to move closer to the parents, but still maintains a separate residence; the green line is for the case in which an adult child opts to live with the parents; the blue line is the optimal decision when the child's utility is maximized given the options to move closer or coreside with the parents. The income on the x-axis is the yearly income earned in units of $10,000 if the agent chooses to work 40 percent of his/her discretionary time.

Appendix B.2 discusses two important parameters in the model that govern the location and shape of the time transfer function with respect to the child's income. First, a higher parental wage rate shifts the time transfer function to the right as shown in Figure B.1. Intuitively, when the parents' earning potential is higher, the child's income also needs to be higher to make the parents be willing to provide time assistance. When the typical yearly income increases from $30,000 to $50,000, the child's income range with positive time transfer shifts from $20,000-$60,000 to $40,000-$80,000, which is consistent with our intuition. Second, the effective time assistance is a concave function of parental time transfer in the baseline model, which makes the initial unit of time transfer more helpful for children. If a linear transfer transformation is used, the income band with positive time transfer to the child is narrowed as shown in Figure B.2. The baseline parameters for time transfer from parents to a child are more consistent with the actual data which show that parental time help is provided to children within a wide range of the income distribution.

The findings in our paper help to explain why more successful children are more likely to live farther away from their parents' homes, and why family members have an incentive to leave and have their own separate dwelling as income rises (Ketchum, 1954). In summary, Figure 2.1 and Figure 2.2 show that money transfer and coresidence are more valuable as adult children's income decreases, while the impact of time transfer is limited to certain range of children's earnings rates.

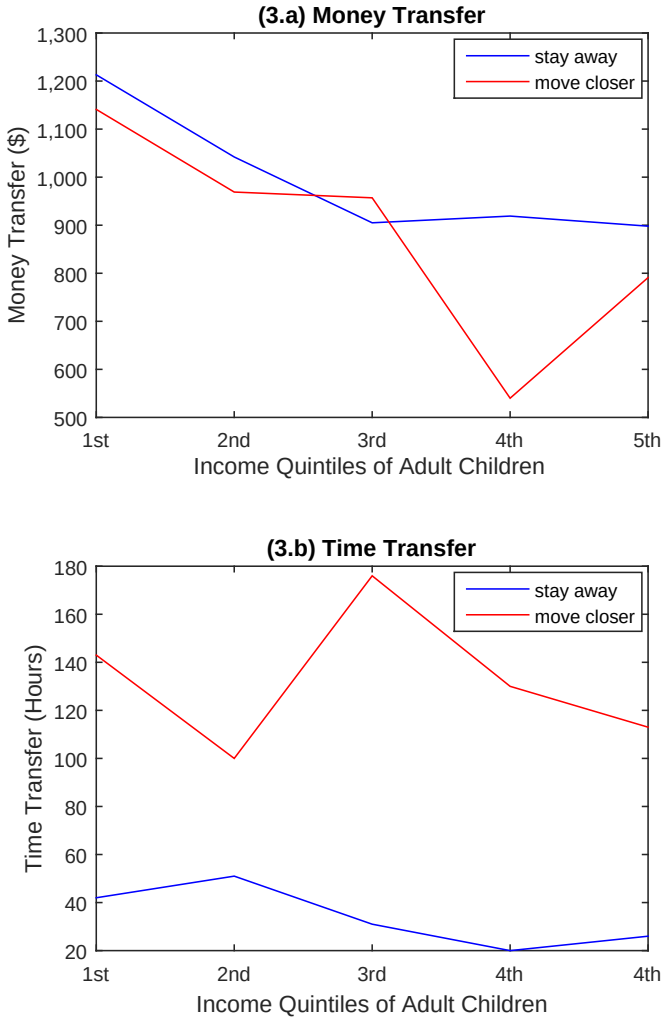
2.5.3 Empirical Evidence from the Transfer Data

The theoretical model in Subsection 2.5.2 predicts that the relationship between time transfer and a child's earnings opportunity is not monotone, while money help always increases as income rises. This subsection examines whether these patterns can be discovered from the real-life data using PSID.

Figure 2.3 plots the intergenerational transfers corresponding to each income quintile of adult children. The sample is the same as in Table 2.6 of Subsection 2.3.3. It is limited to children who initially established homes in a different county from their parents' in 2007 and still maintained an independent residence in 2013. Adult children were aged between 25 and 45, and parents were aged between 43 and 70 in the 2013 survey. Average transfers for income quintiles are calculated separately for those staying distant from parents in a different county and those moving to the same county as their parents'.

Parental transfers can be affected by many factors, such as parents' income, wealth held by parents and adult children, as well as demographic characteristics. To control for these additional factors, we run a first-stage Tobit regression to take out the part that can be predicted by first and second orders of parental income and total wealth of both generations, and by demographic features included in eqn.(2.1).

Figure 2.3: Average Transfers for Income Quintiles of Adult Children



NOTE: The sample is limited to children who initially established homes in a different county from their parents' in 2007 and still maintained an independent residence in 2013. Adult children were aged between 25 and 45, and parents between 43 and 70 years old in the 2013 survey. The child is considered as moving closer if he/she moved back to the parents' county in 2013.

Conditioning on these variables, we calculate the residual amount of transfers, and compute the average for income quintiles of adult children in two sub-samples.[10] The association between intergenerational transfers and a child's income is consistent with the theoretical prediction. Adult children in the lowest income quintile always received much more financial assistance from parents than those in other quintiles. Overall, money transfer decreases as a child's income increases as in Figure 2.3.a for both movers and non-movers.[11] In contrast to financial transfer, time assistance peaks either in the third quintile for movers or the second quintile for non-movers. Adult children in both the top and bottom quintiles received relatively less time help from parents as shown in Figure 2.3.b.

One additional thing worth noting is that adult children who remained distant from parents fared much better than those who chose to move closer in terms of earnings. The four cutoff points for income quintiles are [3.5, 6.0, 8.8, 13.0] in units of $10,000 for non-movers and [1.7, 3.3, 5.4, 8.6] for movers.

2.6 Further Evidence from the Use of Time Supplemental Study

Section 2.3 shows the association between geographical proximity and intergenerational time transfer. Adult children who chose to move closer to their parents were more likely to get time assistance from their parents. Section 2.5 proves that time transfer helps adult children by relaxing their time constraint and allowing them to work more. This part uses the supplemental study of Disability and Use of Time to further study the specific forms of time assistance provided to adult children.

The PSID conducted two rounds of the Disability and Use of Time Study (DUST) in 2009 and 2013. We use the 2013 study to match the sample period used in Subsection 2.3.3. The DUST asked respondents to report time spent caring for others in two separate diaries. For the day before each interview, participants were asked about the number of hours and minutes spent caring for any adult and any child under the age of 18. We calculate the hours of parents caring for adult children and grandchildren accordingly. The associated estimation equation is:

$$CareHours_{i,13} = \beta_0 + \beta_1 Move_{i,07-13} + \beta_2 Weekday_i + \gamma_1 X_{i,13} + \gamma_2 State_{s_i,13} + \varepsilon_i. \quad (2.9)$$

The outcome variables are total hours spent caring for adult children and grandchildren for two diary reporting days. $Move_{i,07-13}$ is a dummy indicating whether an adult child initially living

[10] The top and bottom one percent of time and money transfers in each subgroup are excluded to avoid the impact of extreme values.

[11] Because the first-stage regression takes out the constant term, the red line for children staying away from parents cannot be directly compared with the blue line for those moving back in Figure 2.3.

in a different county finally moved back to the parents' county by 2013. $Weekday_i$ indicates whether the time reported was on Weekdays (from Monday to Friday) or on Weekends (Saturday or Sunday). $X_{i,13}$ is a set of demographic variables as in eqn.(2.1). The state-fixed effect is included as a control variable.

Estimation results are shown in Table 2.8. It is obvious that the parents will spend more time caring for grandchildren if their child moves back to the same county. Adult children on average received 0.91 - 1.88 more hours of child care during weekends from parents in 2013 if they chose to relocate to their parents' county between 2007 and 2013. They could have received 0.75 - 0.89 more hours on weekdays. If these numbers were for typical weekdays and weekends, then closer proximity to parents could have resulted in over 300 more hours in a given year. In contrast, adult children themselves did not receive more caring hours from their parents because of the proximity.

In conclusion, the estimated coefficients imply that grandchild care should be an important reason for adult children's geographical movements. Parental time assistance could have freed adult children from taking care of their own kids, and allowed them to provide more market labor. The results shown in this section are also consistent with previous literature emphasizing the positive effect of grandparenting on labor supply (Zamarro, 2011; Posadas and Vidal-Fernandez, 2013).

Table 2.8: Estimation Results of the Impact of Relocation on Care Hours

	(1) Grandchild Care *Diary 1*	(2) Grandchild Care *Diary 2*	(3) Adult Child Care *Diary 1*	(4) Adult Child Care *Diary 2*
Move Back = 1	1.884***	0.906*	0	0.043
	(0.706)	(0.537)	-	(0.017)
Weekday = 1	-1.137**	-0.010	0	-0.017
	(0.540)	(0.443)	-	(0.014)
Obs.	368	361	366	361
R^2	0.22	0.16	-	0.08

NOTE: The sample is the same as that in Table 2.4. The estimation equation is shown in eqn.(2.9). Control variables include demographic variables for the adult child and parents, and the state-fixed effect. PSID family weights are used for calculations.
Standard errors are reported in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

2.7 Conclusion

This paper studies how adult children make relocation decisions to take advantage of time transfer from parents as a form of extended-family insurance. It first documents the fact that adult children who received bigger negative income shocks during the Great Recession were more likely to move to live closer to their parents. Only one tenth of these movers chose to reside within their parents'

homes. Therefore, there were a substantial portion of them who moved not due to a rent-saving motive, but potentially due to non-monetary parental assistance such as time transfer. Through a two-generation model, we explain how parental time transfer possibly influences and connects to children's labor supply decisions. The paper then compares time transfer with financial transfer and coresidence, and highlights the key differences among them in terms of the impact on adult children's behavior. Furthermore, we discover that relocation is linked with more grandchild care instead of direct care provided to adult children themselves.

CHAPTER 3

Adjusting Educational Decisions to the Housing Bust

3.1 Introduction

The return to post-secondary education in terms of wages has been rising since 1980s (Deschłnes, 2001; Lemieux, 2006; Mincer, 1996), but at the same time, the direct cost to obtain post-secondary education has also been increasing rapidly. Average total tuition, fees, room and board rates charged for full-time undergraduate students in degree-granting institutions increased from $9,138 to $20,234 from 1982 to 2013, in constant 2012-13 dollars (Table 3.1). These trends imply that children reaching college age are more likely to seek financial support from parents for higher education. There is a growing literature studying the impact of parental income and wealth on children's educational attainment. The earlier literature mainly focuses on the role played by family income (Bailey and Dynarski, 2011; Belley and Lochner, 2007; Cameron and Heckman, 2001; Carneiro and Heckman, 2002). Most literature finds a positive relationship between family income and children's educational achievement conditional on ability, and the positive association has become stronger over time. More recent studies start to emphasize the importance of family housing wealth on college investment decisions (Johnson, 2014; Lovenheim, 2011; Lovenheim and Reynolds, 2013).[1] This new strand of research is driven by the fact that more families have been taking home equity loans to finance their children's higher education, due to the increasing ease of borrowing since the early 2000s.[2] In this paper, I apply the instrument variable (IV) estimation strategy, and study how short-run changes in parental wealth affected children's post-secondary educational decisions during the housing bust period.

This paper examines various margins of adjustment in educational attainment for those in post-secondary education. As young adults went through the housing market crash and Great Recession, there were several responses, ranging from wealth and pension management by the parents,

[1] Throughout this paper, home equity and housing wealth are used interchangeably, while home value and housing price refer to the same subject.

[2] Papers discussing the structural change in the mortgage market and increasing liquidity of home equity include Bennett et al. (2001), Hurst and Stafford (2004), and La Cour-Little (2000).

Table 3.1: Average Total Tuition, Fees, Room and Board Rates Charged for Full-Time Undergraduate Students in Degree-Granting Institutions

Year and Control of Institution	All Institutions	4-year Institutions	2-year Institutions
1982-83	9,138	10,385	6,396
1992-93	12,097	14,216	6,830
2001-02	14,775	17,708	7,424
2002-03	15,262	18,344	7,943
2003-04	16,104	19,276	8,336
2004-05	16,647	19,925	8,563
2005-06	17,014	20,289	8,412
2006-07	17,547	20,934	8,461
2007-08	17,737	21,160	8,346
2008-09	18,421	21,996	8,879
2009-10	18,839	22,515	9,109
2010-11	19,355	23,118	9,323
2011-12	19,741	23,409	9,461
2012-13	20,234	23,872	9,574

NOTE: All nominal values are adjusted to Constant 2012-13 dollars based on the Consumer Price Index prepared by the Bureau of Labor Statistics.
DATA SOURCE: U.S. Department of Education, National Center for Education Statistics (2015). Digest of Education Statistics, 2013 (NCES 2015-011), Table 330.10.

added borrowing, and working more to cover educational and living expenses. In addition, evidence is presented regarding the extent to which educational attainment plans were altered. The paper contributes to the existing literature on the role of parental resources in children's academic achievements. It utilizes the unique data provided in the Panel Study of Income Dynamics (PSID) to explore many educational outcomes rarely studied before, due to limited data sources. The panel structure makes it feasible to analyze both the extensive and intensive margins of the influence of parental wealth on young adults' post-secondary educational decisions. For the extensive margin, I first examine whether college enrollment itself is affected by movements in parental wealth. To identify the impact on college attendance, I create two cross-sectional cohorts according to the information provided in the PSID survey, one cohort reaching college age of 18-19 in 2009 and the other reaching college age in 2011. Both cohorts experienced the period of dramatic changes in housing prices within four years prior to attending college. Since a simple OLS regression from the change in parental net assets to college enrollment is likely to bias the estimate, I use the unanticipated change in the house value four years prior to reaching college age as a plausibly valid instrument. Second, I study whether changes in family wealth influence the probability of college students dropping out of school early. I further limit the sample to those already enrolled in college in 2007 to mitigate selection bias. Changes in housing prices from 2007 to 2009 are used to construct the IV when estimating the impact on the possibility of early dropout, as well as the intensive

margin. In the baseline IV estimation, there is only some suggestive evidence for a positive wealth effect on the likelihood of college enrollment. For young adults who already entered college before the housing bust, this paper also fails to find a significant influence on the likelihood of dropping out of college early, within two years of the unexpected declines in parental home values.

On the intensive margin, I study how college students adjusted their financing options in response to possible discontinued monetary support from their parents due to worsening financial conditions. The sample is limited to those who were already enrolled in college in 2007. There is statistically significant evidence that students took more loans under their own names during the housing market downturn, and that they worked more per week to support themselves financially. Parents' income flows during this period also played an important role in determining the amount of loans their children would take on and the hours worked while in college. The estimation results here have important implications for the financial and labor markets. Due to the dramatic declines in housing prices from 2007 to 2009, college students on average took on $200 less student debt, while taking on $275 more in other debts. Moreover, the average working time of college students rose by 10% to 12% due to the declines in housing prices during the bust period.

The remainder of the paper is organized as follows. Section 3.2 provides descriptive patterns and detailed information about the PSID. Section 3.3 specifies the identification strategy. Section 3.4 reports and discusses estimation results. Section 3.5 offers some further discussion, and Section 3.6 concludes.

3.2 Data Description

The main data used in the analysis comes from the PSID family-level, individual-level, and Transition into Adulthood (TA) study. The PSID has collected information from a nationally representative sample of families since 1968 and their descendants have been followed continuously as well. PSID family- and individual-level data are available annually from 1968 to 1997, and since 1997 the studies have been conducted biennially. These data contain detailed information on educational attainment, demographic characteristics, income, and employment history. More importantly, family wealth information was collected as part of family-level data every five years from 1984 to 1999, after which it has been collected every other year until 2015. The wealth data from the PSID provides information on various types of family assets and debts, and specifically, it gives housing prices and home equity across different years.[3]

[3]The wealth data measures home equity and non-housing assets which are divided into seven categories: net value of farm or business; checking and savings accounts; other real estate; stock balance; vehicles; value of annuity/IRA; other assets. Total debt value (excluding home loans) is also measured and categorized into credit card debt, student loan, medical debt, legal debt, and family loan debt in the 2011 and 2013 PSID surveys.

The PSID initiated a Child Development Supplement (CDS) in 1997 to collect additional information from families with children between 0-12 years old. In 2002-2003 and 2007, the CDS re-interviewed families in CDS-I who remained active in the PSID panel. The CDS serves the purpose of studying the dynamic process of early human capital formation, and provides researchers with a unique opportunity to link children's development, such as intellectual achievement and social relationships, to family characteristics, neighborhood and school environments. The CDS was terminated in 2007, but starting in 2005, the Transition into Adulthood data have been gathered biennially, with the latest wave of 2013 released in December of 2014. The TA study was introduced to follow development and outcomes of children who participated in the PSID-CDS study as they transitioned into adulthood (aged between 18 and 25). These data help to understand how experience and environment during childhood could possibly affect outcomes in adulthood when participants achieved economic independence and entered the main PSID study as heads and wives. The TA module includes information on educational attainment, employment experience, family formation, student debt participants were burdened with when interviewed, and so forth. These response variables, combined with information from the biennial data from their parents, make it possible to study the impact of parental wealth on educational decisions more comprehensively.

This paper mainly studies how young adults' educational decisions were affected by dramatic and unexpected movements in parents' wealth during the housing-bust period. I briefly show whether TA respondents changed educational plans because of economic conditions in Table 3.2, according to their answers to related questions in the survey. In TA surveys from 2009 to 2013, young adults were specifically asked whether the current economic recession changed their educational plans. In addition, if they did change their plans because of the Great Recession, they were asked to categorize the specific influence of the recession on their educational plans. Overall, a substantial share of TA participants reported changes in their educational plans from the beginning of the economic recession to 2011. For both cohorts aged between 18 and 22 in 2007 (column 2) and 2009 (column 3), more than 40 percent of the respondents said they adjusted their education-related investment accordingly up to the year 2011. Among different adjustment choices, 3-4 percent chose to drop out of school, 6-10 percent returned to or got enrolled in school, 8-10 percent postponed returning to school, and 7-9 percent changed their major at some point between the onset of the recession and 2011.

It is worth exploring why young adults responded so strongly to the economic conditions since the collapse of housing market. While lower opportunity costs of going to school can help to explain why people chose to return or get enrolled in school, other categories listed in Table 3.2 are probably related to changes in parents' income and wealth status. Without adequate funds to cover collegiate expenses themselves, young adults usually seek help from parents to cover the costs of going to college. The deterioration in their parents' economic status could have significantly

Table 3.2: Changing Educational Plans Due to the Current Recession

	(1) 2007-2009	(2) 2007-2011	(3) 2009-2011
Changed Education Plan (%)	26.0	44.1	42.3
: Dropped Out	1.2	3.8	3.2
: Returned to or Enrolled in School	2.6	9.8	6.4
: Postponed Returning to School	5.5	9.7	8.1
: Stayed in School	1.1	2.3	1.6
: Changed Major	3.6	7.1	9.0
: Borrowed Money	0.1	0.2	0.4
: Other	14.3	26.7	27.2

NOTE: Percentages are calculated using answers from related TA surveys from 2009 to 2011. TA weights in corresponding years are used for calculations. The sample is limited to participants aged between 18 and 22 at the beginning of each period. Assume the economic recession began in 2007. For the first column, a respondent was considered to have changed his/her educational plan if he/she said so in 2009. For the last two columns, he/she was considered as having changed the plan if any change was reported in 2009 or 2011.

reshaped their decisions. Table 3.3 shows the percentage of college students receiving financial support from parents or relatives to pay for their tuition. In 2007, the last survey year before the housing bust broke out, 54 percent of college students aged between 18 and 22 said their tuition was at least partially covered by parents or other relatives. The percentage of students receiving assistance declined as the housing market crashed in 2007 and the economy went into a recession later on. This share partially recovered in 2013. The portion of students receiving monetary assistance at the age of 18 or 19 is quite similar to the overall average across all survey years. The evidence shown in Table 3.3 indirectly confirms that changes in young adults' educational choices could have been attributed to reduced financial support from parents.

Table 3.3: Percentage of College Students Receiving Financial Assistance from Parents or Other Relatives

	2007	2009	2011	2013
Whether Tuition Covered (Aged 18-22)	54.4	51.6	48.2	52.8
Whether Tuition Covered (Aged 18-19)	60.9	48.0	44.7	54.9

NOTE: The sample is limited to TA respondents enrolled in college each survey year. The TA weight in each corresponding year is used for calculations.

The deterioration of parents' wealth status and earnings affected the financial assistance given to their children near college age, and this paper aims to quantify the wealth effect on young adults' post-secondary educational decisions. During the financial-crash period, all important markets, including housing, stock and used car markets, dried up simultaneously. Therefore during the housing bust and Great Recession, it is infeasible to examine the housing-wealth effect independently. In this paper, I impose the assumption that the wealth effects of different types of assets are similar, and therefore total family wealth can be used to estimate the wealth effect. The separate impact from the dramatic decline in housing price is further calculated after appropriate estimation. Details of the estimation strategy are discussed in Section 3.3.

3.3 Estimation Strategy

Section 3.3 describes the key estimation methods applied in the paper. As mentioned in the introduction section 3.1, I examine both the extensive and intensive margins related to adjustments in young adults' educational decisions. Along the extensive margin, I assess whether the college enrollment was significantly affected by changing parental wealth, mainly caused by the collapse of the housing market. For college students already enrolled in college before the housing crash, I study how the unanticipated drop in parental wealth was related to the early dropout rate. Students could have dropped out of college if their parents happened to be those seriously hit by the housing bust and experienced substantial difficulty in financing their children's education.

As for the intensive margin, I investigate whether college students changed their way of financing educational expenditures when parents' net wealth declined dramatically. For most outcome variables, I analyze the impact within two years of the housing bust, and the main purpose is to prevent confounding effects from the subsequent prolonged Great Recession. When the Great Recession kicked in and continued for years, college students' post-secondary decisions could be further influenced by their perceived prospects of obtaining collegiate education. Once the estimated impact of family wealth is pinned down, it is just one step away from figuring out how the sharp decline in wealth, especially home equity, during the housing bust period may have affected young adults' college prospects. More details are provided in each subsection below.

The change in family wealth, the key explanatory variable in this paper, potentially suffers from endogeneity. When families tap into assets such as home equity or savings accounts to pay for their children's education, lower family wealth would be associated with higher educational attainment. Thus this leads to a downward bias in the estimated effect. I utilize the housing market collapse from 2007 to 2009 to correct this bias. For all educational outcome variables mentioned above, unexpected and dramatic movements in housing prices from 2007 to 2009 are used to construct the instrumental variable so that the effect of parental wealth can be consistently identified.

3.3.1 College Enrollment

The positive relationship between college enrollment and home equity has been well established in previous literature.[4] This paper studies the same topic using a modestly different specification. Since home equity and other types of family wealth co-moved with each other during the housing bust, it is impossible to separate the effect of home equity from the effect of other wealth. Thus, total family wealth is used to evaluate the wealth effect on college enrollment. To deal with the endogeneity of changes in parental wealth, short-run unexpected changes in home value within four years before children reach college age are used as the instrumental variable. Two repeated cross-sectional cohorts are created, one aged 18-19 in 2009 and the other aged 18-19 in 2011 from the PSID surveys. Both of these cohorts experienced the major part of the housing bust from 2007 to 2009 within four years prior to their reaching college age. In Appendix C.1, I show that parental investment in children's post-secondary education in each period is mainly determined by the accumulated wealth and income in that period. Unexpected fluctuations in either wealth or income would cause adjustments in educational investment, and further affect children's behaviors. Accordingly, the baseline IV regression used to identify the impact of changes in parental wealth on college enrollment is as follows:

$$Enroll_i = \beta_0 + \beta_1 \Delta Wealth_{i,t} + \beta_2 \Delta Y_{i,t} + \beta_3 Wealth_{i,t-4} + \beta_4 \overline{Y}_{i,t} + \beta_5 Own_{i,t} + \gamma_1^{'} Char_i + \gamma_2^{'} State_{i,t} + Cohort_i + \epsilon_i. \quad (3.1)$$

$Enroll_i$ is a dummy variable indicating whether the respondent ever attended college before the age of 22. $Enroll_i$ is assigned 1 if the respondent reported being enrolled in college in the survey year he/she was 18 or 19 years old, or reported being enrolled in the survey year right before or after that. For example, the individual at the age of 18 or 19 in 2007 is considered as having attended college if he/she reported being enrolled in any one of 2005, 2007 and 2009 TA surveys. $\Delta Wealth_{i,t}$ is the change in parental wealth from $(t-4)$ to t, where t is the year the child reached the age of 18 or 19. $Wealth_{i,t-4}$ is parental wealth four years prior to the child reaching college age. $\Delta Y_{i,t}$ is the change in total family income earned by respondent i's parents from $(t-3)$ to $(t+1)$. $\overline{Y}_{i,t}$ is average family income earned in $(t-3)$, $(t-1)$ and $(t+1)$. For example, for the cohort reaching college age in 2007, $\overline{Y}_{i,t}$ is the average of total family incomes earned in 2004, 2006 and 2008, while $\Delta Y_{i,t}$ is the change in income from 2004 to 2008. The reason for using the next year's income is that the PSID has been conducted biennially and only family income in the

[4] Lovenheim (2011) finds college enrollment is raised by 0.7 of a percentage point if parental home equity increases by \$10,000, while Johnson (2014) finds it increases the probability by 2.6 percentage points. Other related literature inlcudes Dynarski (2003), which finds that financial aid to young adults substantially affects college attendance: an increase of \$1,000 in grant aid raises the probability of going to college by about 3.6 percentage points.

previous year is recorded. Total family income from the previous year is not used because it is already reflected in the current year's wealth status. All financial variables are inflation-adjusted to 2007 constant U.S. dollars using the CPI for all urban consumers (CPI-U). $Own_{i,t}$ is an indicator of whether the respondent's parents owned a house when the respondent reached college age. This dummy is included to account for the selection into homeownership. $Char_i$ is a set of control variables about the TA respondent's and the family head's demographic characteristics. It includes the race and gender of each respondent, the family head's educational attainment, age, gender, and marital status, and the number dependents under the age of 18. $State_{i,t}$ includes the state-level unemployment rate and state-level real GDP per capita.[5] The former is used to control for local economic conditions when respondents were of normal college age, while the state-level real GDP per capita can control for local high-skilled labor demand. The cohort effect for the two cohorts defined above is $Cohort_i$, which is effectively the same as the year effect.

The instrument for $\Delta Wealth_{i,t}$ is the change in parents' house value from 2005 to 2009 for the cohort aged 18 or 19 in 2009, and for the cohort reaching college age in 2011, it is the change from 2007 to 2011. Only non-movers during the four-year period are used in the estimation. β_1 is identified under the assumption that the home price movement four years prior to reaching normal college age is correlated with the change in family wealth, and is orthogonal to the error term conditional on other variables. Standard errors are clustered at the state level to account for correlated errors within local areas. However, there are several issues that cannot be solved even using the short-run home price change during the housing bust as the instrument. First, dollar changes in home value are not strictly exogenous. Wealthier families owned more housing wealth and were expected to have bigger changes during the boom and bust periods. These families were also more likely to invest in children's education prior to college enrollment. Thus, characteristics that made households suffer more during the housing bust are related to those leading their children to attain higher education. The estimated wealth effect on college enrollment is biased downward even under IV. In this sense, the proportional change in the housing price may be more suitable to serve as a valid instrument. Nevertheless, in practice, the instrument constructed by proportional changes is too weak to help estimate the impact of parental wealth on college going decisions. Second, if parents of higher-ability children sort into areas with higher housing-price growth or lower declining rates within the state, the endogeneity is not solved by IV estimation.

3.3.2 Early Dropout

The following two subsections focus on young adults who were already enrolled in college before the major collapse of the housing market, and study how dramatic movements in family wealth

[5] Real GDP per capita at the state level comes directly from the U.S. Bureau of Economic Analysis, and unemployment data comes from the Bureau of Labor Statistics Local Area Unemployment Statistics.

affected their subsequent educational decisions. With less support from parents, children enrolled in college could have reversed course and dropped out before completing it. This subsection investigates whether family wealth changes during the years when young adults are enrolled in college affect their likelihood of dropping out of school in the short run. The key regression equation is as follows:

$$Dropout_i = \beta_0 + \beta_1 \Delta Wealth_{i,07-09} + \beta_2 \Delta Y_{i,07-09} + \beta_3 Wealth_{i,05} + \beta_4 \overline{Y}_{i,09} + \beta_5 Own_{i,07} + \gamma_1^{'} Char_i + \gamma_2^{'} State_{i,09} + Cohort_i + \epsilon_i. \quad (3.2)$$

$\Delta Wealth_{i,07-09}$ is the change in family total wealth from 2007 to 2009, and $\Delta Y_{i,07-09}$ is the income change during this period. I use family income earned in 2006 as a proxy for income in 2007, and use the average income in 2008 and 2010 as a proxy for income in 2009. It is possible that families with higher initial wealth were less likely to have kids drop out given the same decline in family wealth during the housing bust, and therefore I include total wealth in 2005 to control for the level effect. The average income around the year of 2009 ($\overline{Y}_{i,09}$) is included for a similar reason. $\Delta Wealth_{i,07-09}$ is possibly endogenous, because if parents took money out of accumulated wealth or took loans to finance their children's educational bills, then a bigger drop in parental wealth would be associated with a lower dropout rate. To avoid an underestimation of the effect of parental wealth on the early dropout rate, $\Delta Wealth_{i,07-09}$ is instrumented using the change of house value between 2007 and 2009 to deal with the endogeneity. The dependent variable is a dummy variable indicating whether an individual enrolled in college in the 2007 TA survey ended up getting no college degree. There are two sets of dropout indicators. One is whether a respondent enrolled in 2007 was no longer enrolled and didn't get any college degree in 2009. The other is whether a respondent enrolled in 2007 was no longer enrolled and didn't obtain any degree in either the 2009 or the 2011 survey. $Own_{i,07}$ indicates whether parents owned their own home in 2007, and $State_{i,09}$ is the state-level unemployment rate and state-level GDP per capita in 2009. $Char_i$ is a set of demographic variables about the TA respondent and the head of the family. $Cohort_i$ is the cohort effect defined based on the respondent's first year of college enrollment. Standard errors are clustered at the state level to account for local area correlations.

3.3.3 Financing Educational Expenses

Before the housing bubble burst, the economy and financial markets looked rosy. Parents would not have expected the shrinkage of family assets, and might have well planned to tap into wealth such as home equity to finance their kids' college education. However, those who had already sent their children to college right before the housing market crash could have experienced enormous

difficulties in providing further support to kids, when housing prices dramatically declined over a short period of time. This subsection examines how changes in parental wealth influence young adults' choices to get their expenditures covered during college. First, I study whether financial help coming from parents was related to the degree of economic misfortune during the housing market crash. Second, this subsection examines whether college students took more student loans and other debt under their own names to finance educational expenses, in the face of less assistance from parents. Third, college students whose parents had difficulty providing financial support might have chosen to work more hours outside of class; thus it is of interest to explore the relevance of parental wealth to part-time work.

For the first question, the regression equation to examine the impact of family wealth on financial help provided to children in college is:

$$\Delta FinHelp_{i,07-09} = \beta_0 + \beta_1 \Delta Wealth_{i,07-09} + \beta_2 \Delta Y_{i,07-09} + \beta_3 Wealth_{i,05} + \beta_4 \overline{Y}_{i,09} + \beta_5 Own_{i,07} + \gamma_1^{'} Char_i + \gamma_2^{'} State_{i,09} + Cohort_i + \epsilon_i. \quad (3.3)$$

$\Delta FinHelp_{i,07-09}$ is the change in financial help provided by parents or other relatives from 2007 to 2009. Other variables are defined in the same way as in Subsection 3.3.2. The sample is limited to TA participants who were enrolled in college in the 2007 TA survey. Some of these college students were no longer enrolled in the 2009 survey, and therefore I include a dummy variable indicating whether they were still enrolled in 2009 or not. For the second set of research questions, the regression equations are:

$$\Delta TotLoan_{i,07-09} = \beta_0 + \beta_1 \Delta Wealth_{i,07-09} + \beta_2 \Delta Y_{i,07-09} + \beta_3 Wealth_{i,05} + \beta_4 \overline{Y}_{i,09} + \beta_5 Own_{i,07} + \gamma_1^{'} Char_i + \gamma_2^{'} State_{i,09} + Cohort_i + \epsilon_i, \quad (3.4)$$

$$\Delta StuLoan_{i,07-09} = \beta_0 + \beta_1 \Delta Wealth_{i,07-09} + \beta_2 \Delta Y_{i,07-09} + \beta_3 Wealth_{i,05} + \beta_4 \overline{Y}_{i,09} + \beta_5 Own_{i,07} + \gamma_1^{'} Char_i + \gamma_2^{'} State_{i,09} + Cohort_i + \epsilon_i, \quad (3.5)$$

$$\Delta OtrLoan_{i,07-09} = \beta_0 + \beta_1 \Delta Wealth_{i,07-09} + \beta_2 \Delta Y_{i,07-09} + \beta_3 Wealth_{i,05} + \beta_4 \overline{Y}_{i,09} + \beta_5 Own_{i,07} + \gamma_1^{'} Char_i + \gamma_2^{'} State_{i,09} + Cohort_i + \epsilon_i. \quad (3.6)$$

Eqn. (3.4) is meant to evaluate how the change in parents' wealth affected the incremental burden of total debt borne by students from 2007 to 2009. The hypothesis tested is whether a larger decline in parental wealth led to a larger rise in additional loans taken from 2007 to 2009. Eqn. (3.5) and

(3.6) estimate the impacts on the incremental student debt and other types of debt in the targeted period separately. The sample used is college students who were enrolled in college as in the 2007 TA survey. For all equations above, the key coefficient to be estimated is β_1, which reveals the responsiveness of incremental debt to family wealth change. The signs of β_1s are not very clear from the theoretical point of view. On one hand, a bigger drop in parental wealth tends to increase the burden borne by students themselves; on the other hand, worse parental wealth status prevents college students from borrowing more under their own names. As discussed before, if parents utilized their own wealth to fund their children's education, a larger decline in family wealth would be associated with a smaller increase in the amount of loans taken by their children, thus biasing the estimate downward. The unexpected movements in housing prices from 2007 to 2009 are used as an exogenous event to perform IV estimation.

The last set of questions tested in this paper ask whether college students work more when their parents experience unexpected declines in total wealth. Those who were hit by the housing crash after they went to college needed to figure out additional financial resources to continue, since their parents were likely to be liquidity constrained due to worsening wealth status. Besides taking more loans themselves, young adults could have chosen to work more outside of class. The main regression equations are as follows:

$$AveWks_{i,0809} = \beta_0 + \beta_1 \Delta Wealth_{i,07-09} + \beta_2 \Delta Y_{i,07-09} + \beta_3 Wealth_{i,05} + \beta_4 \overline{Y}_{i,09} + \beta_5 Own_{i,07} + \gamma_1^{'} Char_i + \gamma_2^{'} State_{i,09} + Cohort_i + \epsilon_i, \quad (3.7)$$

$$ChgWks_{i,07-0809} = \beta_0 + \beta_1 \Delta Wealth_{i,07-09} + \beta_2 \Delta Y_{i,07-09} + \beta_3 Wealth_{i,05} + \beta_4 \overline{Y}_{i,09} + \beta_5 Own_{i,07} + \gamma_1^{'} Char_i + \gamma_2^{'} State_{i,09} + Cohort_i + \epsilon_i, \quad (3.8)$$

$$AveWkHrs_{i,0809} = \beta_0 + \beta_1 \Delta Wealth_{i,07-09} + \beta_2 \Delta Y_{i,07-09} + \beta_3 Wealth_{i,05} + \beta_4 \overline{Y}_{i,09} + \beta_5 Own_{i,07} + \gamma_1^{'} Char_i + \gamma_2^{'} State_{i,09} + Cohort_i + \epsilon_i, \quad (3.9)$$

$$ChgWkHrs_{i,07-0809} = \beta_0 + \beta_1 \Delta Wealth_{i,07-09} + \beta_2 \Delta Y_{i,07-09} + \beta_3 Wealth_{i,05} + \beta_4 \overline{Y}_{i,09} + \beta_5 Own_{i,07} + \gamma_1^{'} Char_i + \gamma_2^{'} State_{i,09} + Cohort_i + \epsilon_i. \quad (3.10)$$

$AveWks_{i,0809}$ is the average number of weeks worked in 2008 and 2009. $ChgWks_{i,07-0809}$ is the change in the number of weeks worked, comparing that in 2007 with the average of 2008 and 2009. $AveWkHrs_{i,0809}$ is the average number of hours worked per week in 2008 and 2009.

$ChgWkHrs_{i,07-0809}$ is the change in the number of weekly hours worked, comparing that in 2007 with the average of 2008 and 2009. All the explanatory and control variables are defined in the same way as in Subsection 3.3.2, and the sample used is college students enrolled in both 2007 and 2009. Estimation results are reported in Section 3.4.

3.4 Main Results

3.4.1 College Enrollment

OLS and IV regression results of the impact on college enrollment are reported in Table 3.4. There is only weak evidence to support the idea that the change in family wealth four years prior to reaching college age affects young adults' propensity to attend college. An exogenous $10,000 decrease in parental wealth reduces the likelihood of being enrolled in college by 0.05 of a percentage point on average. The U.S. college enrollment rate of 18-22 years olds in 2007 was 48.73%, and thus a $10,000 decline in family wealth decreased the college enrollment rate by 0.10%. Using the PSID data, real house value on average declined by $46,562 for families with children at the age of 18 or 19 in 2009 or 2011, which implies a decrease in college enrollment of 0.48%. For lower-income families with a total income of less than $70,000, an exogenous $10,000 decrease in parental wealth results in a 1.31 percentage-point decrease in the probability of college attendance, which translates to a marginal effect of 2.69%. The estimated effect is larger for poorer families, which is consistent with previous literature. Using the estimated coefficient for lower-resource families as the upper bound, a decline of $46,562 in home value results in a 12.52% drop in college enrollment. However, the estimated coefficient lacks statistical significance. Overall, there were not enough movers on the extensive margin to substantially influence the college enrollment rate. The negative impact on college attendance through the reduction in housing wealth of families with college-age children is limited.

My results are consistent with some previous literature which finds very little evidence of financial constraints affecting college attendance. Keane and Wolpin (2001) find borrowing constraints have essentially little effect on college enrollment decisions. Nevertheless, they find that relaxing borrowing constraints does lead to increased borrowing by college students, reduced market work and increased consumption while enrolled in college. Cameron and Taber (2004) also conclude that policies aimed at easing credit constraints will have hardly any impact on schooling attainment. While the likelihood of college enrollment wasn't significantly affected during the housing bust, children might have ended up entering a college that was different from their expectation (Lovenheim and Reynolds, 2013). Families with larger declines in their wealth, particularly house value, might have selected lower quality and less expensive schools. For example, they could

Table 3.4: OLS and IV Estimates of the Wealth Effect on College Enrollment

	(1) OLS	(2) IV	(3) IV low Inc.[1]
ΔWealth ($10,000)	0.0001	0.0005	0.0131
	(0.0001)	(0.0005)	(0.0085)
ΔIncome ($10,000)	-0.0006	0.0002	0.0197*
	(0.0010)	(0.0015)	(0.0119)
Wealth 4 Years Prior ($10,000)	0.0003**	0.0006*	0.0142**
	(0.0002)	(0.0003)	(0.0070)
Perm. Income ($10,000)	0.0020*	0.0001	0.0092
	(0.0010)	(0.0021)	(0.0285)
Homeowner	0.1697**	0.1805***	0.1149
	(0.0646)	(0.0630)	(0.0829)
State-Level Unemp.	0.0198*	0.0250***	0.0311*
	(0.0105)	(0.0095)	(0.0164)
State-Level Real GDP	3.5148	4.1885**	-0.1092
Per Capita ($1,000)	(2.1919)	(2.0898)	(3.4832)
Obs.	676	654	371
R^2	0.197	0.195	0.093
First-Stage Home		0.5431**	0.4144***
Price Estimates		(0.2522)	(0.0880)
First-Stage F-Statistic		4.64	22.17
Weak-Instrument Robust CI		[-0.0014,	
for ΔWealth		0.0025]	

[1] The sample is limited to families with a permanent income of less than $70,000 when children reached normal college age.

NOTE: Author's estimation of eqn.(3.1) using the PSID repeated cross section of 18-19-years old in 2009 and 2011. All financial variables are in constant 2007 U.S. dollars adjusted by CPI-U. All models include cohort and state-fixed effects. Other control variables include the head-of-household's education, age, gender, and marital status, the number of dependents under the age of 18, and the TA respondent's race and gender. PSID family weights upon enrollment are used for calculations. For the IV estimations, changes in housing value within four years prior to children reaching college age are used to construct the instrument. Standard errors clustered at the state level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

have attended a community college instead of a more selective one when family wealth declined unexpectedly, or they might have gone to an in-state college instead of an out-of-state one.

3.4.2 Early Dropout

The previous subsection reports the impact on college attendance for young adults whose parents were hit by housing market fluctuations before they reached college age. This part studies the influence on those who had already gone to college and were part way through when the housing bust kicked in. Table 3.5 shows the regression results with early dropout as the outcome variable. For the first three columns, the change in the parental income from 2007 to 2009 is calculated by taking the difference between the income for 2006 and the average income for 2008 and 2010. The reason for constructing the income change in this way is explained in Subsection 3.3.2. The remaining three columns use the income change from 2006 to 2010 to see whether the estimated effect is sensitive to the income specification. The outcome variable in columns (1), (2), (4) and (5) is whether college students enrolled in 2007 reported that they were no longer enrolled in college in 2009 and didn't get any degree. The outcome variable in columns (3) and (6) is whether college students enrolled in 2007 were not enrolled and didn't obtain any degree in either 2009 or 2011. The IV estimation indicates that changes in family wealth hardly affect the probability of dropping out of college before the completion of degree requirements. Given that the average decline in housing value during the bust from 2007 to 2009 was $49,304, the estimated coefficient suggests that on average the early dropout rate increased by approximately 0.05 of a percentage point due to reduced housing wealth during the housing market crash. Nevertheless, the estimate lacks statistical significance. Another point worth mentioning is that higher permanent family income (statistically) significantly reduces the chance of dropping out of college early. For a family with a higher average income from 2008 to 2010, each $10,000 reduced the probability of children dropping out of college early by 0.34-0.46 of a percentage point.

In conclusion, this paper fails to find a significant wealth effect on either college enrollment or the possibility of early dropout. It is worth noting that the wealth effect on the dropout rate is likely to be underestimated. In the face of worsening economic conditions during the housing bust period, some students might have chosen to drop out early without a degree, but others might have chosen to stay at school for a longer time or postpone returning to school, as shown in Table 3.2.

3.4.3 Financing Options

This subsection reports and discusses the impact of family wealth on the intensive margin of children's educational decisions. For young adults who were enrolled in college before the housing bubble burst in 2007, dramatic changes in family wealth could have substantially affected their

Table 3.5: OLS and IV Estimates of the Wealth Effect on Early Dropout

	Preferred Income Change[3]			Alt. Income Change[3]		
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS[1]	IV[1]	IV[2]	OLS[1]	IV[1]	IV[2]
Δwealth ($\$10,000$)	0.0002***	-0.0000	-0.0001	0.0002**	-0.0000	-0.0001
	(0.0001)	(0.0003)	(0.0004)	(0.0001)	(0.0004)	(0.0005)
ΔIncome ($\$10,000$)	-0.0003	0.0000	0.0005	0.0001	-0.0004	-0.0006
	(0.0011)	(0.0011)	(0.0011)	(0.0007)	(0.0014)	(0.0017)
Wealth in 2005 ($\$10,000$)	0.0002	0.0003	0.0003	0.0003**	0.0002	0.0002
	(0.0003)	(0.0003)	(0.0003)	(0.0001)	(0.0002)	(0.0003)
Perm. Income ($\$10,000$)	-0.0045***	-0.0034*	-0.0039*	-0.0045***	-0.0037**	-0.0046**
	(0.0011)	(0.0017)	(0.0022)	(0.0012)	(0.0018)	(0.0021)
Homeowner	-0.0522	-0.0397	-0.1050	-0.0534	-0.0387	-0.1022
	(0.0684)	(0.0667)	(0.0707)	(0.0675)	(0.0667)	(0.0686)
State-Level Unemp.	-0.0094	-0.0096	0.0098	-0.0094	-0.0096	0.0097
	(0.0064)	(0.0066)	(0.0112)	(0.0064)	(0.0067)	(0.0114)
State-Level Real GDP	-0.0004	-0.0003	-0.0012	-0.0004	-0.0003	-0.0012
per capita ($1,000)	(0.0009)	(0.0008)	(0.0009)	(0.0009)	(0.0009)	(0.0009)
Obs.	357	347	349	357	347	349
R^2	0.118	0.124	0.152	0.117	0.124	0.155
First-Stage Home		2.4921***	2.4918***		1.8674***	1.8668***
Price Estimates		(0.6698)	(0.6691)		(0.4776)	(0.4779)
First-Stage F-Statistic		13.84	13.87		15.28	15.26

[1] Students enrolled in 2007 with no prior college degree are considered as dropping out early if they were no longer enrolled in 2009 and didn't get any degree.

[2] Students enrolled in 2007 with no prior college degree are considered as dropping out early if they were no longer enrolled and didn't get any degree in either 2009 or 2011.

[3] The preferred income change is the change from 2006 to the average of 2008 and 2010. The alternative income change is the change from 2006 to 2010.

NOTE: author's estimation of eqn.(3.2). All financial variables are in constant 2007 U.S. dollars adjusted by CPI-U. All models include cohort and state-fixed effects. Other control variables include the head-of-household's education, age, gender, and marital status, the number of dependents under the age of 18, and the TA respondent's race and gender. 2007 PSID family weight is used for calculations. The instrument is the change in home value from 2007 to 2009. Standard errors clustered at the state level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

choices to finance education. The sharp drops in housing values increased borrowing costs, with less home equity to serve as collateral. Unanticipated declines in other liquid assets also reduced the financial resources available to parents to fund their children's education. Students could either choose to take more loans under their own names or work more hours to support themselves. Otherwise, students had no choice but to drop out of college. The estimation results from Eqn. (3.3) are shown in Table 3.6. Declines in family wealth during the housing market crash significantly reduced the amount of financial help provided by parents or other relatives. A $10,000 drop in parental wealth decreases financial assistance provided to the child by $76 to $83 in a given year.

Table 3.6: OLS and IV Estimates of the Wealth Effect on Financial Help

	(1) OLS	(2) IV	(3) IV Alt. Inc.[1]
ΔWealth ($10,000)	28.70	83.34	76.35**
	(29.02)	(52.08)	(30.46)
ΔIncome ($10,000)	74.77	-42.15	87.40
	(98.39)	(120.98)	(107.71)
Wealth in 2005 ($10,000)	4.37	20.35	25.37
	(22.97)	(29.02)	(28.46)
Perm. Income ($10,000)	168.50	101.01	161.77
	(173.25)	(177.57)	(171.90)
Homeowner	6,099.71*	6,234.39*	6,133.83*
	(3,477.89)	(3,294.55)	(3,259.29)
State-Level Unemp.	396.39	355.48	336.39
	(445.24)	(454.73)	(460.88)
State-Level Real GDP	49.55	33.42	39.78
per Capita ($1,000)	(63.18)	(45.90)	(45.43)
Obs.	298	292	292
R^2	0.212	0.199	0.207
First-Stage Home		1.05***	1.49***
Price Estimates		(0.15)	(0.19)
First-Stage F-Statistic		45.87	61.71

[1] The preferred income change is the change from 2006 to the average of 2008 and 2010. The alternative income change is the change from 2006 to 2010.
NOTE: author's estimation of eqn.(3.3). All financial variables are in constant 2007 U.S. dollars adjusted by CPI-U. All models include cohort and state-fixed effects. Other control variables include the head-of-household's education, age, gender, and marital status, the number of dependents under the age of 18, the TA respondent's race and gender, and whether the respondent was still enrolled in 2009. 2007 PSID family weight is used for calculations. The instrument is the change in home value from 2007 to 2009. Standard errors clustered at the state level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

With less support provided by parents or other relatives, students should have tried other ways to finance their expenses. Table 3.7 and Table 3.8 show whether students took out more loans during college. As discussed in Section 3.3, the wealth impact on debts taken by children themselves

is ambiguous. On one hand, children from families with deteriorating wealth status demand more loans from outside sources, but on the other hand, they are prevented from borrowing more due to less collateral value from parents. There is strong evidence to support the negative wealth effect on the amount of total debts taken on by children. For an exogenous decline in total family wealth of $10,000, the amount of total loans taken on in two years is $14 to $23 higher on average. Accordingly, the decline in home value during the housing market crash from 2007 to 2009 contributed to a greater loan value of up to $113.

Table 3.7: OLS and IV Estimates of the Wealth Effect on Total Debts

	(1) OLS	(2) IV	(3) IV Alt. Inc.[1]
ΔWealth ($10,000)	-9.33**	-13.67	-22.88**
	(3.92)	(10.16)	(11.62)
ΔIncome ($10,000)	-34.02	-35.14	-62.17
	(30.25)	(31.51)	(43.42)
Wealth in 2005 ($10,000)	3.36	2.20	2.81
	(7.60)	(7.11)	(6.58)
Perm. Income ($10,000)	100.14	125.76*	104.09
	(62.53)	(74.15)	(83.76)
Homeowner	1,998.32	2,077.62	2,095.51
	(2,144.54)	(2,115.89)	(2,112.43)
State-Level Unemp.	506.31**	529.51**	545.04**
	(225.47)	(228.02)	(224.06)
State-Level Real GDP per Capita ($1,000)	5.63	8.71	6.88
	(32.28)	(31.64)	(32.77)
Obs.	361	351	351
R^2	0.147	0.149	0.144
First-Stage Home Price Estimates		2.49***	1.86***
		(0.64)	(0.44)
First-Stage F-Statistic		14.82	17.92

[1] The preferred income change is the change from 2006 to the average of 2008 and 2010. The alternative income change is the change from 2006 to 2010.
NOTE: author's estimation of eqn.(3.4). All financial variables are in constant 2007 U.S. dollars adjusted by CPI-U. All models include cohort and state-fixed effects. Other control variables include the head-of-household's education, age, gender, and marital status, the number of dependents under the age of 18, the TA respondent's race and gender, and whether the respondent was still enrolled in 2009. 2007 PSID family weight is used for calculations. The instrument is the change in home value from 2007 to 2009. Standard errors clustered at the state level are in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

It is interesting to see that the wealth effect on student debt and other types of debt are of opposite signs. From Table 3.8, a bigger drop in parental wealth leads to a smaller incremental amount of student debt, while leading to more other debts taken on by college students. If the decline in family wealth is $10,000 greater, the incremental amount of student debt is about $35 to

$39 lower, while the incremental amount of other debts is $48 to $55 higher. By back-of-envelope calculation, college students took $200 less student debt, while taking $275 more in other debts on average, due to the dramatic declines in housing prices from 2007 to 2009.

In conclusion, the estimation results confirm a negative correlation between family wealth and loans taken by college students, with the exception of student debt. Young adults borrowed more under their own names to fund their education. This is more consistent with the story that richer families provide more assistance to their children, thus reducing the financial burden on college-age children.

Table 3.8: OLS and IV Estimates of the Wealth Effect on Student Debt and Other Debts

					Alt. Inc.[1]	
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	IV	IV	IV	IV
	Stu. Debt[2]	Otr. Debt[3]	Stu. Debt[2]	Otr. Debt[3]	Stu. Debt[2]	Otr. Debt[3]
ΔWealth ($10,000)	10.46	-21.33**	39.07*	-48.12*	35.13	-54.74**
	(7.99)	(8.84)	(22.31)	(27.55)	(21.66)	(27.68)
ΔIncome ($10,000)	-10.62	-35.73	-31.90	-19.61	48.84	-74.38
	(43.30)	(60.49)	(61.68)	(75.38)	(55.15)	(68.15)
Wealth in 2005 ($10,000)	-0.23	-1.46	2.46	-4.59	8.80	-6.26
	(12.64)	(17.61)	(13.31)	(17.47)	(10.63)	(15.68)
Perm. Income ($10,000)	-225.82*	361.86**	-394.75**	520.82***	-330.10**	473.23***
	(118.67)	(158.41)	(157.78)	(185.70)	(138.89)	(170.03)
Homeowner	6,556.81**	-3,829.16**	6,826.02***	-3,946.89**	6,670.32**	-3,885.38**
	(2,751.00)	(1,883.25)	(2,647.61)	(1,860.48)	(2,595.74)	(1,807.86)
State-Level Unemp.	-350.32	718.87	-464.73	838.46	-465.62	856.08
	(504.01)	(510.61)	(510.85)	(526.78)	(509.79)	(534.78)
State-Level Real GDP	62.35*	-62.28	52.93	-51.10	54.00	-53.49
per Capita ($1,000)	(36.01)	(51.19)	(34.55)	(54.18)	(34.02)	(54.91)
Obs.	360	356	350	346	350	346
R^2	0.163	0.211	0.152	0.203	0.158	0.198
First-Stage Home			2.43***	2.45***	1.86***	1.87***
Price Estimates			(0.64)	(0.64)	(0.44)	(0.44)
First-Stage F-Statistic			14.09	14.26	17.85	17.99

[1] The preferred income change is the change from 2006 to the average of 2008 and 2010. The alternative income change is the change from 2006 to 2010.

[2] The outcome variable is the incremental amount of student debt from 2007 to 2009.

[3] The outcome variable is the incremental amount of other debts from 2007 to 2009.

NOTE: author's estimation of eqn.(3.5)-eqn.(3.6). All financial variables are in constant 2007 U.S. dollars adjusted by CPI-U. All models include cohort and state-fixed effects. Other control variables include the head-of-household's education, age, gender, and marital status, the number of dependents under the age of 18, the TA respondent's race and gender, and whether the respondent was still enrolled in 2009. 2007 PSID family weight is used for calculations. The instrument is the change in home value from 2007 to 2009. Standard errors clustered at the state level are in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

When parents experienced difficulty in financing their children's education, college kids could have also worked more while in college to continue, in addition to taking more loans themselves. The TA data have records of total weeks worked and average hours worked per week in the previous two years. Table 3.9 shows the wealth effect on these two outcome variables for college students enrolled in both 2007 and 2009. Overall, the results in Table 3.9 provide some evidence

that both hours and weeks worked were related to family wealth status, though many estimates lack statistical significance. A $10,000 decline in family wealth within two years caused college students to work 0.28 more weeks and 0.26 more hours per week. If the average decline in housing value of $49,304 from 2007 to 2009 is used, it implies college students could have worked 1.38 more weeks, and 1.28 more hours per week each year on average. Conditional on the fact that the average weeks worked by college students in 2007 was 13.6, the average number of weeks worked increased by 10.1% due to the average decline in the home price. The average hours worked per week rose by approximately 12.8%, given the average weekly hours of 10 for college attendees in 2007. Other wealth and income variables hardly affected weeks or hours worked. In summary, when parents were economically hit and became more constrained after the housing bust, college students relied on themselves to finance education costs, either through taking out more loans or making more money.

Table 3.9: OLS and IV Estimates of the Wealth Effect on Weeks and Weekly Hours Worked

	(1) OLS Weeks[1]	(2) OLS Chg. Wks[2]	(3) OLS Hours[3]	(4) OLS Chg. Hrs[4]	(5) IV Weeks[1]	(6) IV Chg. Wks[2]	(7) IV Hours[3]	(8) IV Chg. Hrs[4]
ΔWealth ($10,000)	-0.0432	-0.0338	-0.0269	-0.0262	-0.2757*	-0.1578	-0.2617*	-0.0645
	(0.0335)	(0.0256)	(0.0257)	(0.0227)	(0.1615)	(0.1292)	(0.1502)	(0.0945)
ΔIncome ($10,000)	0.2976	0.1966	0.2480	0.0629	0.6705*	0.4286	0.6067*	0.2078
	(0.1964)	(0.2542)	(0.1527)	(0.2368)	(0.3559)	(0.2874)	(0.3419)	(0.2445)
Wealth in 2005 ($10,000)	0.0066	-0.0070	0.0086	0.0124	0.0283	0.0031	0.0321	0.0030
	(0.0193)	(0.0274)	(0.0172)	(0.0293)	(0.0444)	(0.0356)	(0.0426)	(0.0299)
Perm. Income ($10,000)	0.0309	0.1038	0.1769	0.1388	0.1528	0.1485	0.3072*	0.1595
	(0.1956)	(0.2380)	(0.1474)	(0.2264)	(0.2061)	(0.2512)	(0.1837)	(0.2496)
Homeowner	2.3261	4.2617	0.0753	0.2265	1.7261	4.5579	0.0176	1.0562
	(3.6812)	(3.5146)	(3.3000)	(4.1075)	(4.5633)	(3.7514)	(3.5963)	(3.7089)
State-Level Unemp.	0.8444	1.0052	0.3450	0.4910	-0.5764	0.4219	-1.0440	0.8368
	(0.8379)	(0.8668)	(0.5588)	(0.7268)	(1.7895)	(1.4309)	(1.4657)	(0.9324)
State-Level Real GDP	-0.1298	-0.0531	-0.0856	0.0654	-0.0331	0.0269	0.0064	0.0778
per Capita ($1,000)	(0.1725)	(0.1972)	(0.1796)	(0.2424)	(0.2444)	(0.2267)	(0.2327)	(0.2439)
Obs.	131	130	132	131	125	124	126	125
R^2	0.189	0.193	0.223	0.123	-0.299	0.012	-0.718	0.086
First-Stage Home					1.0055**	1.0062**	1.0222**	1.0228**
Price Estimates					(0.4471)	(0.4466)	(0.4412)	(0.4407)
First-Stage F-Statistic					5.06	5.08	5.37	5.39
Weak-Instrument Robust CI					[-0.9088,	[-0.6640,	[-0.8504,	[-0.4351,
for ΔWealth					0.3573]	0.3484]	0.3269]	0.3060]

[1] The outcome variable is average weeks worked from 2008 to 2009.

[2] The outcome variable is the difference in weeks worked in 2007 and average weeks worked from 2008 to 2009.

[3] The outcome variable is average weekly hours worked from 2008 to 2009.

[4] The outcome variable is the difference in weekly hours worked in 2007 and average weekly hours worked from 2008 to 2009.

NOTE: author's estimation of eq.(7)-(10). All financial variables are in constant 2007 U.S. dollars adjusted by CPI-U. All models include cohort and state-fixed effects. Other control variables include the head-of-household's education, age, gender, and marital status, the number of dependents under the age of 18, and the TA respondent's gender and race. The sample is limited to TA participants enrolled in college in both 2007 and 2009, and 2007 PSID family weight is used in the estimation. The instrument is the change in home value from 2007 to 2009. Standard errors clustered at the state level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

3.5 Further Discussion

3.5.1 Evidence of Cashing Out

Most U.S. families have very limited liquid assets in the form of savings or checking accounts, and hardly any assets such as stocks, bonds, or certificates of deposit. Housing wealth is usually a dominant component of family assets. When experiencing financial difficulty during the housing bust, parents' ability to use home equity as collateral was undermined. Thus, parents might have sought other sources to support their kids in college. Although the majority of them had vehicles, a vehicle could not serve as a liquid asset for emergency funds when financial status worsened. Thus the only option they were left with was money saved in a pension, annuity or individual retirement account. Parents could have cashed out a pension, annuity or IRA to fund their children's educational expenses when they experienced financial distress themselves. Table 3.10 shows whether having a child enrolled in college increased the chance of parents cashing out their pension. The

Table 3.10: The Estimated Impact of Having a College-Age Child on the Probability of Cashing Out a Pension/IRA/Annuity

	OLS Wtr. Cashed[1]	IV Wtr. Cashed[1]
Having a kid > 20 in college	-0.0176	-0.0206*
	(0.0116)	(0.0109)
Having a kid ≤ 20 in college	0.0329**	0.0382***
	(0.0147)	(0.0144)
ΔWealth, excluding IRA ($\$10,000$)	-0.0002	0.0002
	(0.0001)	(0.0002)
ΔIncome ($10,000)	0.0008	0.0010
	(0.0005)	(0.0009)
Wealth in 2005 ($10,000)	-0.0001	0.0001
	(0.0001)	(0.0001)
Perm. Income ($10,000)	0.0035	0.0007
	(0.0022)	(0.0029)
Obs.	966	939
R^2	0.038	0.012
First-Stage Home Price Estimates		1.7575***
		(0.5494)
First-Stage F-statistic		10.23

[1] Whether cashed out pension/IRA/annuity from 2007 to 2009.
NOTE: All financial variables are in constant 2007 U.S. dollars adjusted by CPI-U. 2007 PSID family weight is used in the estimation. The instrument is the change in home value from 2007 to 2009. Standard errors clustered at the state level are in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

benchmark is families with no child enrolled in college. Compared with the benchmark, families with at least a child in college under or at the age of 20 were more likely to have cashed out a

pension, annuity or IRA from 2007 to 2009 by 3.82 percentage points. Nonetheless, families with college children over the age of 20 were less prone to cashing out, compared with the benchmark group. In summary, there is strong evidence for a positive association between having a college-age child and the possibility of costly cashing out either a pension or an IRA. Parents would have cashed out their retirement account to support their child's educational costs during the housing bust.

3.5.2 Changes in the Housing Value Endogenous?

In Section 3.4, I assume that the change in the home value during the housing bubble burst is strictly exogenous and thus can be used as a valid instrument to estimate the impact of family wealth. For example, when I evaluate the impact on college enrollment, I impose the assumption that changes in parental house prices within four years prior to reaching college age are exogenous and orthogonal to the error term. However, there is still a possibility that these changes are endogenous. In the case of college enrollment, if wealthier families own more housing wealth and are expected to experience bigger changes during the boom and bust periods, the instrument is not valid. The home value change can be correlated with a child's characteristics, and the IV estimates are no longer consistent.

I partially address this issue by using local housing price changes instead of shocks to individual families. The annual housing price index by five-digit zip code is taken from the Federal Housing Finance Agency. The PSID data provide geospatial information at the household level, including the five-digit zip code. Therefore, the annual housing price index at the zip code where a household lived can be well tracked. The housing price index (HPI) is adjusted for inflation by the CPI. For college enrollment, I use local HPI changes within four years prior to children becoming college age at the zip-code level as the instrument for changes in parental wealth. The new instrument is intuitively more exogenous and requires fewer assumptions for it to be valid. For other outcome variables, endogenous variations in family wealth are instrumented by zip-code HPI changes from 2007 to 2009.

Estimated parental wealth impacts on various post-secondary educational decisions are reported in Table 3.11. The change in the housing price index at the zip-code level suffers from the weak-instrument problem across all the regressions. The variation in the constructed HPI is not sufficient to help identify the parental wealth effect, combined with the limited sample size of the PSID data after selection.[6] The issue of weak IV possibly contributes to the statistical insignificance of estimated coefficients. A weak IV results in a larger standard error for the instrumented variable, thus affecting the statistical significance of the targeted variable.

[6] As shown in Tables 3.5-3.9, the same instrument becomes weaker as the sample size declines. A larger sample size would be helpful to boost the relevance of the instrument variable.

The overall patterns still persist when the new instrument is applied, despite lack of statistical significance. Comparing the original and new IV regressions, a more exogenous instrument generally points to greater estimated coefficients, and predicts more substantial consequences of parental wealth for children's educational decisions.

Table 3.11: IV Estimates of Parental Wealth Effect on Education (Alternative Instrument)

	Enrollment	Dropout	Alt. Dropout	Dropout (Alt. Inc. Chg.)	Alt. Dropout (Alt. Inc. Chg.)			
ΔWealth ($10,000)	0.0083	0.0000	-0.0019	-0.0001	-0.0018			
	(0.0081)	(0.0025)	(0.0030)	(0.0024)	(0.0027)			
First-Stage Home	0.1926	0.2371**	0.2344**	0.2444***	0.2451***			
Price Estimates	(0.1332)	(0.1038)	(0.1012)	(0.0912)	(0.0890)			
First-Stage F-Statistic	2.09	5.22	5.37	7.17	7.58			
	Fin. Help	Fin. Help (Alt. Inc. Chg.)	Total Debts	Stu. Debt (Alt. Inc. Chg.)	Otr. Debts	Total Debts (Alt. Inc. Chg.)	Stu. Debt	Otr. Debts (Alt. Inc. Chg.)
ΔWealth ($10,000)	78.98	87.12	-4.54	109.68	-184.36	-9.27	106.61	-186.64
	(208.69)	(253.49)	(79.34)	(141.40)	(162.73)	(69.96)	(127.90)	(139.33)
First-Stage Home	0.15***	0.17***	0.23**	0.23**	0.24**	0.26**	0.25**	0.26**
Price Estimates	(0.05)	(0.06)	(0.11)	(0.11)	(0.11)	(0.10)	(0.10)	(0.10)
First-Stage F-Statistic	7.86	6.93	4.29	4.28	4.4	6.11	6.36	6.56
	Weeks	Chg. Weeks (Alt. Inc. Chg.)	Hours	Chg. Hours (Alt. Inc. Chg.)				
ΔWealth ($10,000)	-0.0913	-0.3901	-0.5264	-0.2138				
	(0.2805)	(0.3864)	(0.4473)	(0.2140)				
First-Stage Home	0.1700	0.1679	0.1840	0.1864				
Price Estimates	(0.1602)	(0.1613)	(0.1643)	(0.1632)				
First-Stage F-Statistic	1.13	1.08	1.25	1.30				

NOTE: See Tables 3.4-3.9 in Section 3.4 for details of sample selection and variable definitions. For college enrollment, changes in local housing price index within four years prior to children reaching college age are used to construct the instrument. For other outcome variables, the instrument is constructed using local HPI changes from 2007 to 2009. Corresponding PSID family weights are used for calculations. Standard errors clustered at the state level are in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

3.6 Conclusion

This paper studies the impact of parental wealth on children's post-secondary educational choices, by utilizing micro-level data from the Panel Study of Income Dynamics and its supplements. The estimation results I find in this paper shed light on how young adults enrolled in college and their parents adapted to the housing bust and financial crisis, especially in terms of financial responses. Previous literature mostly examines the effect of family wealth on college enrollment and degree completion, due to limited data that follow young adults from their childhood to adulthood. I examine both the extensive margin and intensive margin of the wealth impact on educational decisions. For the former, I estimate the influence on college enrollment and early dropout, and for the latter, I estimate whether college students adjust the amount of loans taken, and time worked during college in the face of reduced financial help from their parents. In this paper, I only find a weak impact on college enrollment using the recent housing bust period to perform the IV estimation. When housing wealth decreased unexpectedly, the tightening credit constraints didn't substantially affect young adults' likelihood of going to college. However, they might have chosen

a lower quality or less selective college/university during the housing bust. If young adults chose to enter a less expensive school in the face of worsening family financial status, the insignificant impact on enrollment fails to tell the whole story. The IV estimation suggests that a $10,000 rise in parental wealth should lead to 0.05 of a percentage-point increase in the probability of college attendance on average. This implies a decrease in college enrollment of 0.48% due to the housing bust from 2007 and 2009. Therefore, there isn't strong evidence that the collapse of the housing bubble significantly reduced educational attendance through reductions in parental wealth, especially declines in housing value.

As for young adults already enrolled in college before the bust, a dramatic decline in parental wealth hardly affected the likelihood of dropping out of college early: a $10,000 decrease in family wealth raised the probability of dropping out within two years by 0.01 of a percentage point, which indicates that on average the early dropout rate increased by at most 0.05 of a percentage point due to drops in housing prices during the housing market crash. Empirical evidence suggests that worsening economic status of parents constrained their ability to provide financial support to their children in college. A $10,000 drop in parental wealth decreased financial assistance provided to children by $76 to $83 in a given year. In the face of reduced help from parents, students took more loans under their own names during the housing market downturn, and they worked more hours to support themselves financially. The declines in home value during the housing market crash from 2007 to 2009 contributed to a greater loan value of $113. Changes in housing prices made college students work 1.38 more weeks and 1.28 more hours per week on average in a year. I also examine whether parents cashed out money from a pension or an IRA to support their children. Having a child under the age of 21 enrolled in college increased the likelihood of withdrawing money from a pension or an IRA by 3 percentage points.

For future work, it would be interesting to study the effect of financial difficulties experienced during college on employment outcomes after graduation. Rothstein and Rouse (2011) find that a heavier load of student debt causes graduates to choose substantially higher-salary jobs and reduces the probability that students choose low-paid "public interest" jobs. It is feasible to use the PSID data to identify the parental wealth effect on occupational choices in a similar fashion. It is worth exploring whether worsening financial status causes college students to choose more financially rewarding jobs instead of jobs they truly love to do.

APPENDIX A

Chapter 1

A.1 Expenditure Shares and Consumption Growth Rates

Consumption growth rates (Figures 1.1 - 1.2 and Table 1.1). PSID consumption expenditure data from 1999 to 2007 are used to calculate the biennial growth rate of nominal consumption. The consumption growth rate is calculated by taking the log difference in nominal expenditures between year t and $t-2$ for all households in the PSID data. Households with zero expenditure in either year are ommitted in calculations since the log difference is undefined. In Figure 1.1.a, food expenditure includes food consumed at home, delivered and also eaten away from home. The growth rate of housing consumption in Figure 1.1.b is defined as follows: it is the log change in housing value for homeowners, and log change in rent for renters. Thus households who switched from being a homeowner to a renter, or otherwise, are excluded from calculations. Figure 1.1.b.1 shows the nominal growth rate of the sum of mortgage payments, home insurance and property tax. Figure 1.1.d reports the distribution of the log change in the sum of vehicle loans and lease payments. Finally, Figure 1.1.e shows the growth rate of expenditures related to car usage, such as parking, gasoline and repairs. The histograms in Figure 1.1 are drawn with a bin size of 0.06, ranging from -1.5 to $+1.5$.

In Table 1.1, the second column reports the fraction of households with a negative nominal growth rate which is defined in the same way as in Figure 1.1.

Expenditure shares (Table 1.1). Expenditure shares are calculated by dividing the expenditure in each category by total expenditures spent on all goods listed in Table 1.1. Housing is the total spending on housing (HOUS), excluding the utility expenditure (UTIL). Other vehicle expenditures combine vehicle down payment (VEHPAY) and additional vehicle expenditures not included in vehicle purchase (VEHADD). Other transportation contains expenses related to bus and train fares (BUS), taxicabs (CAB) and any other type of transportation (OTRAN). Health care includes expenditures for hospital and nursing home (HOS), doctor (DOCTOR), and prescription drugs (PRESCR), excluding the out-of-pocket health insurance (HINS). The last category in Table

1.1, “miscellaneous”, combines education and childcare expenditures.

A.2 Solutions to the Special Case of the Representative Agent Model

This section shows the analytic solutions to the special case of the model laid out in **Subsection 1.3.1**.

(I) No Commitments (Free Adjustment)

The representative household's maximization problem (at $t = 0$) is:

$$\max \sum_{t=0}^{T} \beta^t \left\{ \frac{c_t^{1-\sigma}}{1-\sigma} + \mu \cdot \frac{k_t^{1-\gamma}}{1-\gamma} - \delta \cdot \frac{(h_t^s)^{1+\eta}}{1+\eta} \right\},$$

s.t.

$$\begin{aligned} &c_t + k_t + \frac{A_t}{1+r} = A_{t-1} + y^h + w^s h_t^s \quad \text{for } 0 \leq t \leq T-1, \\ &c_T + k_T = A_{T-1} + y^h + w^s h_T^s. \end{aligned}$$

For simplicity, assume in period 0, the representative family unit believes that the head's income stream is flat thereafter ($y_t^h = y^h$). In the absence of borrowing constraints, the intertemporal budget constraint can be rewritten as:

$$\sum_{t=0}^{T} \frac{c_t + k_t}{(1+r)^t} = A_{-1} + \sum_{t=0}^{T} \frac{y^h}{(1+r)^t} + \sum_{t=0}^{T} \frac{w^s h_t^s}{(1+r)^t}.$$

Denote the shadow value of wealth as λ, and the corresponding first-order conditions are:

$$\begin{aligned} \partial c_t: &\quad c_t^{-\sigma} = \lambda \\ \partial k_t: &\quad \mu k_t^{-\gamma} = \lambda \\ \partial h_t^s: &\quad \delta \cdot (h_t^s)^{\eta} = \lambda w^s \end{aligned}$$

Given $\beta(1+r) = 1$, the consumption of both types of goods and spousal labor supply should be constant over time in the absence of income or wealth shocks:

$$c_t = c_0, k_t = k_0, \text{ and } h_t^s = h_0^s.$$

Suppose in period 1, there is an unexpected income shock to the head of the family. The following two equations are solved to find the response:

$$c_1^{-\sigma} = \mu k_1^{-\gamma}, \tag{A.1}$$

$$c_1 + k_1 = \frac{1-\beta}{1-\beta^T} A_0 + (y^h + \Delta y^h) + w^s h_1^s, \tag{A.2}$$

$$c_1^{-\sigma} = \frac{\delta (h_1^s)^\eta}{w^s}. \tag{A.3}$$

(II) With Commitments

Suppose in period 1, the representative household starts with the same wealth and commitment from the previous period. After a negative income shock to the head, the family chooses between two options (1) maintaining the original commitment which forces the wife to work more, or (2) paying the adjustment cost and re-optimizing on all margins.

(II.1) No adjustment ($k_1 = k_0$). Then the following two equations are solved:

$$c_1 + k_0 = \frac{1-\beta}{1-\beta^T} A_0 + (y^h + \Delta y^h) + w^s h_1^s, \tag{A.4}$$

$$c_1^{-\sigma} = \frac{\delta (h_1^s)^\eta}{w^s}. \tag{A.5}$$

(II.2) Adjusting by paying the adjustment cost. The three equations to be solved are:

$$c_1^{-\sigma} = \mu k_1^{-\gamma}, \tag{A.6}$$

$$c_1 + k_1 = \frac{1-\beta}{1-\beta^T} (A_0 - \xi k_0) + (y^h + \Delta y^h) + w^s h_1^s, \tag{A.7}$$

$$c_1^{-\sigma} = \frac{\delta (h_1^s)^\eta}{w^s}. \tag{A.8}$$

A.3 Income Elasticities of Spousal Labor Supply

(I) The elasticity of spousal labor supply with respect to the head's income without any adjustment and borrowing constraints is solved using:

$$c_1^{-\sigma} = \frac{\delta(h_1^s)^\eta}{w}, \tag{A.9}$$

$$c_1 + \bar{k} = \frac{1-\beta}{1-\beta^{T+1}}\bar{A} + y_1^h + w^s h_1^s. \tag{A.10}$$

From the solution to Case (I), I can get:

$$\varepsilon^{h^s,y^h}|_{h^s=\bar{h},y^h=\bar{y}} = -\frac{dh^s}{dy^h}\cdot\frac{y^h}{h^s}|_{h^s=\bar{h},y^h=\bar{y}} = \frac{1}{\frac{\sigma+\eta}{\sigma}\cdot\frac{w^s\bar{h}}{\bar{y}} + \frac{\eta}{\sigma}(1+\frac{\bar{\Gamma}}{\bar{y}} - \frac{\bar{k}}{\bar{y}})} \tag{A.11}$$

where $\bar{\Gamma} = \frac{1-\beta}{1-\beta^{T+1}}\bar{A}$. The elasticity decreases in the ratios of the spousal income to the primary earner's income ($\frac{w^s\bar{h}}{\bar{y}}$) and liquid assets to the head's income ($\frac{\bar{\Gamma}}{\bar{y}}$), and increases in the ratio of committed consumption to the head's income ($\frac{\bar{k}}{\bar{y}}$).

(II) The elasticity of spousal labor supply with respect to the head's income with an adjustment and without borrowing constraints is solved using:

$$c_1^{-\sigma} = \mu\cdot k_1^{-\gamma} = \frac{\delta(h_1^s)^\eta}{w^s}, \tag{A.12}$$

$$c_1 + k_1 = \frac{1-\beta}{1-\beta^{T+1}}\bar{A} - \xi\frac{1-\beta}{1-\beta^T}\bar{k} + y_1^h + w^s h_1^s. \tag{A.13}$$

From the solution to Case (II), I can get:

$$\varepsilon^{h^s,y^h}|_{h^s=\bar{h},y^h=\bar{y}} = -\frac{dh^s}{dy^h}\cdot\frac{y^h}{h^s}|_{h^s=\bar{h},y^h=\bar{y}} = \frac{1+\Delta}{\frac{\sigma+\eta}{\sigma}\cdot\frac{w^s\bar{h}}{\bar{y}} + \frac{\eta}{\sigma}(1+\frac{\bar{\Gamma}}{\bar{y}} - \frac{\bar{k}}{\bar{y}}) + \frac{\eta}{\gamma}\cdot\frac{\bar{k}^{opt}}{\bar{y}}} \tag{A.14}$$

where $\bar{\Gamma} = \frac{1-\beta}{1-\beta^{T+1}}\bar{A}$. $\bar{k}^{opt}$ depends on $\bar{h}$, and Δ mainly depends on $\frac{\bar{k}}{\bar{y}}$ and the percentage change in y.[1] The elasticity decreases in the ratio of the spousal income to the head's income ($\frac{w^s\bar{h}}{\bar{y}}$) and the ratio of savings to the head's income ($\frac{\bar{\Gamma}}{\bar{y}}$). The elasticity can either increase or decrease in the ratio of the committed consumption to the head's income ($\frac{\bar{k}}{\bar{y}}$).

[1] $\bar{k}^{opt} = \left(\frac{\delta\bar{h}^\eta}{\mu w^s}\right)^{-\frac{1}{\gamma}}$. $\Delta = (\%\Delta y)^{-1}\cdot\left[\frac{\bar{k}}{\bar{y}} - \frac{\bar{k}^{opt}}{\bar{y}} - \frac{\xi(1-\beta)}{1-\beta^T}\cdot\frac{\bar{k}}{\bar{y}}\right]$

A.4 With Endogenous Labor Force Participation

This section provides the analytic solutions to the special case of the model laid out in **Subsection 1.3.2** with labor participation choices.

(I) No Commitments (Free Adjustment)

The representative household's maximization problem (at $t = 0$) is:

$$\max \sum_{t=0}^{T} \beta^t \left\{ \frac{c_t^{1-\sigma}}{1-\sigma} + \mu \cdot \frac{k_t^{1-\gamma}}{1-\gamma} - \delta \cdot \frac{(h_t^s)^{1+\eta}}{1+\eta} \right\},$$

s.t.

$$\begin{aligned} c_t + k_t + \frac{A_t}{1+r} &= A_{t-1} + y_t^h + P_t(w^s h_t^s - F) \quad \text{for } 0 \le t \le T-1, \\ c_T + k_T &= A_{T-1} + y_T^h + P_T(w^s h_T^s - F). \end{aligned}$$

For simplicity, assume in period 0, the representative family unit believes the head's income stream is flat thereafter ($y_t^h = y^h$). In the absence of borrowing constraints, the intertemporal budget constraint can be rewritten as:

$$\sum_{t=0}^{T} \frac{c_t + k_t}{(1+r)^t} = A_{-1} + \sum_{t=0}^{T} \frac{y^h}{(1+r)^t} + \sum_{t=0}^{T} \frac{P_t(w^s h_t^s - F)}{(1+r)^t}.$$

(I.1) Not participating:

$$\begin{aligned} h_0^s = 0, \quad c_0^{-\sigma} &= \mu k_0^{-\gamma}, \\ c_0 + k_0 &= \frac{1-\beta}{1-\beta^{T+1}} A_{-1} + y^h. \end{aligned}$$

(I.2) Participating:

$$\begin{aligned} c_0^{-\sigma} = \mu k_0^{-\gamma} &= \frac{\delta (h_0^s)^{\eta}}{w^s}, \\ c_0 + k_0 &= \frac{1-\beta}{1-\beta^{T+1}} A_{-1} + y^h + w^s h_0^s - F. \end{aligned}$$

Given $\beta(1+r) = 1$, the consumption of both types of goods and spousal labor supply should be constant over time in the absence of income or wealth shocks:

$$c_t = c_0, k_t = k_0, \text{ and } h_t^s = h_0^s.$$

Pick the optimal bundle of $\{c_0, k_0, h_0^s\}$, and calculate the corresponding A_0. Suppose in period 1, there is an unexpected income shock to the head of the family, the following two equations are solved to find the response:

(I.1) Not participating

$$h_1^s = 0, \quad c_1^{-\sigma} = \mu k_1^{-\gamma}, \tag{A.15}$$

$$c_1 + k_1 = \frac{1-\beta}{1-\beta^T} A_0 + (y^h + \Delta y^h). \tag{A.16}$$

(I.2) Participating

$$c_1^{-\sigma} = \mu k_1^{-\gamma} = \frac{\delta (h_1^s)^\eta}{w^s}, \tag{A.17}$$

$$c_1 + k_1 = \frac{1-\beta}{1-\beta^T} A_0 + (y^h + \Delta y^h) + w^s h_1^s - F. \tag{A.18}$$

(II) **With Commitments: No Adjustment ($k_1 = k_0$)**

$$c_t + k_0 + \frac{A_t}{1+r} = A_{t-1} + y_t^h + P_t(w^s h_t^s - F) \quad \text{for } t \geq 1.$$

(II.1) Not participating

$$c_1 + k_0 = \frac{1-\beta}{1-\beta^T} A_0 + (y^h + \Delta y^h). \tag{A.19}$$

(II.2) Participating

$$c_1 + k_0 = \frac{1-\beta}{1-\beta^T} A_0 + (y^h + \Delta y^h) + w^s h_1^s - F, \tag{A.20}$$

$$c_1^{-\sigma} = \frac{\delta (h_1^s)^\eta}{w^s}. \tag{A.21}$$

(III) **With Commitments: Adjusting by Paying the Adjustment Cost**

$$c_1 + k_1 + \xi k_0 + \frac{A_1}{1+r} = A_0 + y_1^h + P_1(w^s h_1^s - F).$$

(III.1) Not participating

$$c_1 + k_1 = \frac{1-\beta}{1-\beta^T}(A_0 - \xi k_0) + (y^h + \Delta y^h), \tag{A.22}$$

$$c_1^{-\sigma} = \mu k_1^{-\gamma}. \tag{A.23}$$

(III.2) Participating

$$c_1 + k_1 = \frac{1-\beta}{1-\beta^T}(A_0 - \xi k_0) + (y^h + \Delta y^h) + w^s h_1^s - F, \tag{A.24}$$

$$c_1^{-\sigma} = \mu k_1^{-\gamma} = \frac{\delta (h_1^s)^\eta}{w^s}. \tag{A.25}$$

APPENDIX B

Chapter 2

B.1 The Timing of the Game and the F.O.C.s

Table B.1 shows the details of the game mentioned in Subsection 2.4.2:

Table B.1: State Variables for Different Stages of the Game

Stage	Conditioning Variables	Choices	By Whom	Strategies	Value Func.
1	$x^1 \equiv a, w^p, w^k$	r	Child	$r^*(x^1)$	$Y^1(x^1)$
2	$x^2 \equiv a, w^p, w^k, r$	T, μ, h^p	Parent	$T^*(x^2), \mu^*(x^2), h^{p*}(x^2)$	$P^2(x^2)$
3	$x^3 \equiv a, w^p, w^k, r,$ T, μ, h^p	h^k	Child	$h^{k*}(x^3)$	$Y^3(x^3)$

where

$$Y^1(x^1) = \max_r \left\{ Y^3(a, w^p, w^k, h^{p*}(x^2), T^*(x^2), \mu^*(x^2) \right\},$$

$$P^2(x^2) = \max_{h^p, T, \mu} \left\{ U^p + \eta U^{k*} \right\},$$

$$Y^3(x^3) = \max_{h^k} \left\{ U^k \right\}.$$

The solution to the child's maximization problem in the third stage is governed by the following first order conditions:

$$z^k = \left(\frac{w^k}{\alpha_3}\right)^{1/\phi_1} [1 - h^k + \zeta \cdot \mathbf{1}\{r \neq 2\} \cdot \mu^\tau]$$
$$(1-\alpha_1)(z^k)^{\phi_1} = \alpha_1 (T + w^k h^k - z^k - \chi \cdot \mathbf{1}\{r \neq 0\} - F \cdot \mathbf{1}\{r \neq 2\})^\rho \cdot$$
$$[1 - h^k + \zeta \cdot \mathbf{1}\{r \neq 2\} \cdot \mu^\tau]^{\phi_1 - \rho} \left[\left(\frac{w^k}{\alpha_3}\right)^{1/\phi_1 - 1} + \alpha_3 \right]^{(\phi_1 - \rho)/(1-\phi_1)}$$

B.2 Important Parameters Governing the Location and Shape of the Transfer-Income Function

Two parameters in the model are discussed regarding their importance in determining the location and shape of the time transfer function with respect to the child's income.

First, the parents' typical yearly income is set at \$30,000 in the benchmark simulation. At that wage rate, children with typical income ranging from \$20,000 to \$60,000 benefit most from time assistance given by parents. A higher typical yearly income at \$50,000 is used to see how the change in parents' earning potential affects the time transfer. Intuitively, a child's income needs to be higher to make the parents optimally provide time assistance when the opportunity cost of doing so goes up. Figure B.1 shows a similar set of figures as in Figure 2.1. A higher parental wage rate shifts the time transfer function to the right. When the typical yearly income increases from \$30,000 to \$50,000, the child's income range with positive time transfer shifts right to \$40,000-\$80,000.

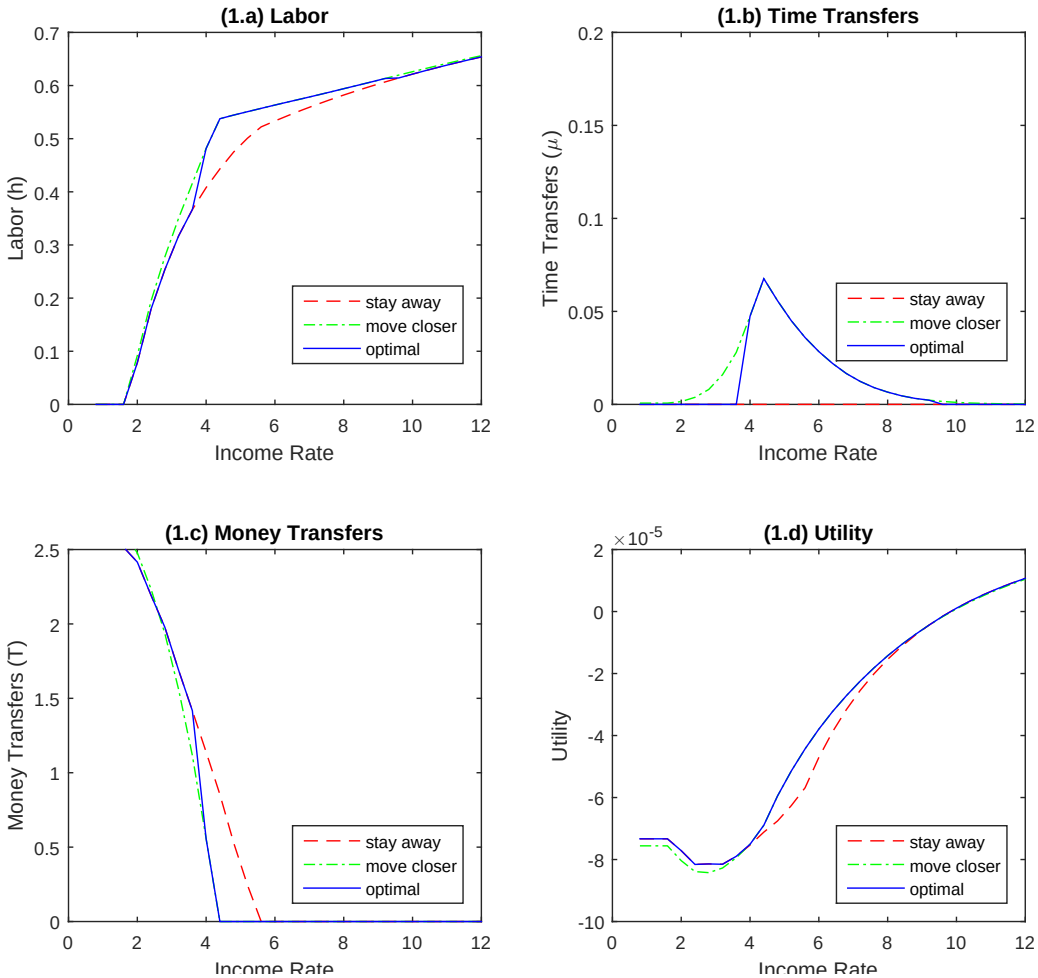
Second, the effective time assistance is a concave function of parental time transfer in the baseline model:

$$\lambda^k = 1 - h^k + \zeta\mu^\tau,$$

which makes the initial unit of time transfer more helpful for children. We set ξ equal to 0.85 to account for the fact that time assistance provided by parents is not as efficient as the time spent by an adult child. τ is set to 0.8 to make the initial time help particularly valuable to the child, and the return to time assistance decline as the amount of time transfer increases. If a linear transfer transformation is used, the income band with positive time help to the child is narrowed as shown in Figure B.2. In this alternative specification, both ξ and τ are set to 1 to make one unit of time assistance equivalent to one unit of time of the child. Only children earning \$30,000 to \$40,000 can benefit from the time transfer in this case, much narrower than the benchmark case in Figure 2.1.

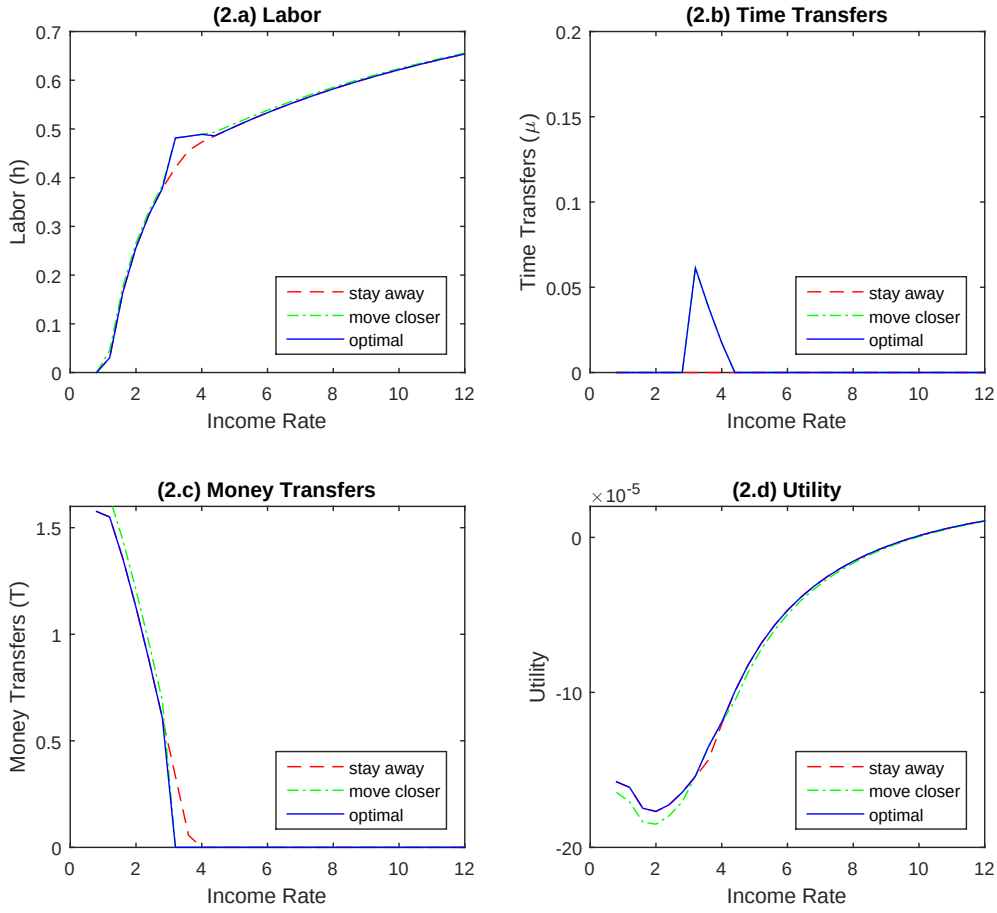
The baseline parameters for time transfer from parents to a child are more consistent with the actual data that the parental time help is provided to children within a wide range of the income distribution. Other parameters are related to the elasticities of substitution and the costs to move, rent or co-reside with the parents, which are less likely to alter the shape and location of the policy function.

Figure B.1: Comparisons between Moving Closer and Staying Distant (Higher Parental Wage)



NOTE: The red line is for the case in which an adult child chooses to stay away from the location of the parents' residence; the green line is for the case in which an adult child opts to move closer to the parents but still maintains a separate residence; the blue line is the optimal decision when a child's utility is maximized given the options to stay away or move closer. The income is the yearly income earned in units of $10,000 if the agent chooses to work 40 percent of his/her discretionary time. The typical yearly income for parents is $50,000, which implies a yearly wage rate of $125,000.

Figure B.2: Comparisons between Moving Closer and Staying Distant (Linear Time Transfer)



NOTE: The red line is for the case in which an adult child chooses to stay away from the location of the parents' residence; the green line is for the case in which an adult child opts to move closer to the parents but still maintains a separate residence; the blue line is the optimal decision when a child's utility is maximized given the options to stay away or move closer. The income is the yearly income earned in units of $10,000 if the agent chooses to work 40 percent of his/her discretionary time. The typical yearly income for parents is $30,000, which implies a yearly wage rate of $75,000.

APPENDIX C

Chapter 3

C.1 Key Factors Affecting Parents' Educational Investment

This part illustrates why the change in parents' investment in their child's education is mainly driven by the change in their income and wealth status. Assume that the family's maximization problem is represented by an infinitely lived agent who solves:

$$max \sum_{t=0}^{\infty} \beta^t \{\log c_t + \eta \log e_t\}$$

s.t.

$$\begin{aligned} t = 0: \quad & c_0 + \frac{a_0}{1+r} + e_0 = a_{-1} + y_0, \\ t = 1: \quad & c_1 + \frac{a_1}{1+r} + e_1 = a_0 + y_1, \\ t \geq 2: \quad & c_t + \frac{a_t}{1+r} = a_{t-1} + y_t. \end{aligned}$$

The interest rate and the initial asset a_{-1} are taken as given. $(1+r)\beta = 1$. Parents only invest in the child's education in two periods, period 0 and 1. Investments in the child's education (e_t) can raise the parents' utility. I impose an additional assumption that when the income is revealed in each period, the representative agent expects all future incomes to be the same as the current one. By solving the problem above, the educational investments in period 0 and 1 are:

$$\begin{aligned} e_0 &= \eta \frac{a_{-1} + \frac{1+r}{r} y_0}{\frac{2+r}{1+r}\eta + \frac{1+r}{r}}, \\ e_1 &= \eta \frac{a_0 + \frac{1+r}{r} y_1}{\eta + \frac{1+r}{r}}. \end{aligned}$$

Thus the change in the parental educational investment can be written as:

$$\Delta e = \beta_1 \Delta a + \beta_2 \Delta y + \beta_3 a_{-1} + \beta_4 y_0.$$

Changes in the parents' investment in their child's post-secondary education lead to adjustments in the child's education-related decisions. This is why in most specifications in this chapter, changes and levels of the parental income and wealth are the key variables included in the regressions.

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