EC 262P V. Joseph Hotz
Population Economics

# Models of Family Interactions and Intrahousehold Resource Allocation

## Becker's Rotten Kid Theorem

## 1. "Mechanisms" for Families to Act Collectively

- "Game Household Head (Parent) and Family Members (children) Play:
    - Altruistic parent who maximizes preferences and re-allocates income, via transfers, so as to maximize income and family well-being
- Examples:
    - Consumption decisions of family members
    - Educational or Health Investments in Children
    - Does husband get to read in bed with the night light on, when wife is light sleeper?
- What are Properties of Becker's Altruistic Family? How Robust are they?

## Rotten Kid Theorem:

- "Altruistic" parents can adjust their transfers to their children to induce, but not coerce, them to take actions that maximize the total income of the family, despite these children being motivated by their narrow self-interest.

  > "Every beneficiary, no matter how selfish, maximizes the family income of his benefactor and thereby internalizes all effects of his actions on other beneficiaries." (Becker, *Treatise on Family*, 1981, p. 183.)

- Becker "family," through its altruistic head, is able to internalize all of the potential externalities that the actions of selfish family members may have on parents (and other members) and thereby achieve Pareto-efficient resource allocations.

- Rotten Kid Theorem implies that altruistic parents do not need to resort to strategic behavior—or have external ways to bind them to precommitted responses to their children's actions—in order to achieve such allocations, since neither Offspring nor parents can improve upon the transfers that altruistic parents make.

# 2. The Parent-Offspring game with perfect and complete information

## The Game Parents and Teenage Offspring Play:

### *Offspring's Utility Function:*

$$U_d \equiv U_d(c_d, b). \tag{1}$$

$c_d$ is the offspring's consumption

$b$ is the offspring's risky behavior, where $b \in \{1,0\}$, with $b = 1$ if $d^{th}$ takes risky action and $b = 0$ otherwise.

### *Parental Preferences:*

- Parents have both "altruistic" and "selfish" dimensions to their preferences, i.e., parents have two *personalities*.

  - Preferences of Selfish Parents or "Consumer-Parents":

$$U_p \equiv U_p(c_p, b). \tag{2}$$

  $c_p$ is parents' own consumption.

  - Preferences of Altruistic Parents, or "Parent-Planners":

$$W_p\left[U_p(c_p, b), U_d(c_d, b)\right]. \tag{3}$$

***Budget Constraints:***

$$I_p = c_p - t$$
$$c_d = t$$

$I_p$ is parents' income

$t$ is the transfer from parents to their child, where $t \in \{1,0\}$, with $t = 1$ if parents make transfer to $d^{th}$ offspring $t = 0$ otherwise

**Parents' and Offspring's Decision Problem or Game:**

For each of the parents' children:

*Stage 1*: Child's Problem:

$$\max_{b} U_d(t,b), \tag{4}$$

*Stage 2*: Parent-Planner's Problem:

$$\max_{t_N, t_{N-1}, \ldots, t_0} \sum_k \delta^k W_p[U_p(I_p - t_k, b_k), U_d(t_k, b_k)], \tag{5}$$

where $b$ is given, $W_{p1} = \dfrac{\partial W_p}{\partial U_p} > 0$ and

$W_{p2} = \dfrac{\partial W_p}{\partial U_d} > 0$.

Parent-Planner's optimal transfer function is constructed so that Parents' and Offspring's marginal utilities of income are equated:

$$W_{p1}\frac{\partial U_p}{\partial (I-t)} = W_{p2}\frac{\partial U_d}{\partial t} \tag{1}$$

Given the optimal function, $t(b)$, defined in (1), the Offspring will choose $b$ so that the Offspring's marginal rate of substitution between consumption and action $b$ equal the Parent Planner's marginal value of her action ($dt/db$):

$$\frac{dt}{db} = -\frac{\frac{\partial U_d}{\partial b}}{\frac{\partial U_d}{\partial t}} \tag{2}$$

According to Rotten Kid Theorem, this sub-game perfect equilibrium choice of $b$ is the parent's most preferred outcome.

As Becker states in *A Treatise on the Family (1981)*, the Offspring, no matter how selfish, maximizes the parent's welfare therefore internalizes all effects of her action on the parent.

# 3. Bergstrom's "Fresh Look at Rotten Kid Theorem"

Bergstrom (1989) shows Rotten Kid Theorem requires that the preferences of all family members be members of the class of ***transferable utility functions***.

*Transferable Utility Functions for Parent and Offspring:*

$$\begin{aligned} U_p &= A(b)(I_p - t) + B_p(b) \\ U_d &= A(b)t + B_d(b) \end{aligned} \tag{3}$$

No parent/offspring subscript on $A(b)$. That is, action $b$ affects the parent's and Offspring's marginal utility of consumption in exactly the same way.

Since the parent's general utility $W_p(U_p,U_d)$ is a cardinal representation of the Planner-Parent's welfare, we can ignore $A(b)$ and rewrite (3) as:

$$\begin{aligned} U_p &= (I_p - t) + B_p(b) \\ U_d &= t + B_d(b) \end{aligned} \tag{4}$$

Note that under transferable utility, parent's attitude about $b$ [$B_p(b)$] is a perfect substitute for the parents' own consumption $c_p = I_p - t$. If the parent feels upset about the risky behavior, such disutility can be fully compensated by some amount of money.

Transferable utility also requires Offspring's preference of action $b$ is perfect substitute for her own consumption, $c_d = t$. Offspring's joy or pain from $b$ can be fully compensated by money.

Thus, the parent's best response of transfer $t(b)$ completely reflects the parent's opinion of $b$. As the Offspring's choice of $b$ is based on the best response function $t(b)$, in the sub-game perfect equilibrium the action $b$ will take into account the parent's opinion therefore coincides with the optimal choice for the parent.

### *Proof of Bergstrom's Result on Rotten Kid Theorem:*

Suppose both the parent and the Offspring display transferable utility. In the sub-game perfect equilibrium, we have

$$\begin{cases} W_{p1} = W_{p2} \\ \dfrac{dt}{db} + \dfrac{dB_d}{db} = 0 \end{cases} \tag{5}$$

It follows that

$$\begin{aligned} \frac{dt}{db} &= -\frac{\dfrac{\partial\left(W_{p1} - W_{p2}\right)}{\partial b}}{\dfrac{\partial\left(W_{p1} - W_{p2}\right)}{\partial t}} \\ &= -\frac{\left(W_{p11} - W_{p21}\right)\dfrac{dB_p}{db} + \left(W_{p12} - W_{p22}\right)\dfrac{dB_d}{db}}{\left(W_{p12} - W_{p22}\right) - \left(W_{p11} - W_{p21}\right)} \qquad (6) \\ &= -\frac{\left(W_{p11} - W_{p21}\right)\dfrac{dB_p}{db} - \left(W_{p12} - W_{p22}\right)\left(\dfrac{dt}{db}\right)}{\left(W_{p12} - W_{p22}\right) - \left(W_{p11} - W_{p21}\right)} \end{aligned}$$

It follows from (6), that $\frac{dt}{db} = \frac{dB_p}{db}$. Combining with (5) leads to

$$\begin{cases} W_{p1} = W_{p2} \\ \frac{dB_p}{db} + \frac{dB_d}{db} = 0 \end{cases} \tag{7}$$

But, these are exactly the same first order conditions that would hold if the Planner-Parent chooses $t$ and $b$ to maximize $W_p[U_p(I_p - t, b), U_d(t, b)]$. Therefore, the Offspring's optimal choice for $b$ also is the optimal choice for the Planner-Parent. *QED*.

*Two Additional Points:*

- The (efficiency) properties of Rotten Kid Theorem is not dependent on imposing any further restrictions on functional form of $B_p(b)$ and $B_d(b)$.

- No matter how strong the parent likes or dislikes $b$, no matter how the parental feelings differ from those of the Offspring, as long as the preference is transferable to money, there are no conflict of interest between the parent and the Offspring.

  - If the parent dislikes the action taken by the Offspring—i.e., $B'_p(b) < 0$)—the parent will reduce their transfers to the Offspring [$dt/db < 0$].

  - If the selfish parent prefers the action $b$—i.e., $B'_p(b) > 0$—she will prefer to increase her transfers to the Offspring [$dt/db > 0$].

  - In both situations the equilibrium action $b$ is optimal for the Offspring and the parent. A strong implication follows: we cannot judge the efficiency of $b$ by merely watching whether the Offspring who commits the action $b$ gets more or less transfers than those Offspring that do not.

**Deterring Risky Behavior among Teens:**
**The Role of Parental Reputation and Strategic Transfers**

by

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**Introduction:**

- Many, if not most, adolescents engage in risky behaviors (e.g., sex, drug and alcohol use, driving fast, etc.)
  - Psychologists argue that such risk taking behavior can be a normal and healthy part of development of a youth's identity and independence.
  - Most of these actions result in little or no negative or permanent harm to teens themselves or others
  - But there are potentially large downside risks to some of these behaviors, given that they can have long-term or permanent adverse affects on youth, families and society.

- Literatures on Adolescent Risk-Taking and its Consequences
  - In Psychology, much attention on the individual decision-making processes of teens with respect to risky behavior and its consequences. Also, some attention to *role of parents* in influencing these risk-taking behaviors and how parents may mitigate their adverse consequences while fostering developmental benefits
  - In Economics and other social sciences, much attention on the incentive effects of market forces (e.g., prices), government policy (e.g., welfare policy, taxes, laws) and social forces (e.g., communities and neighborhoods) as the causes and encouragement of damaging risk-taking behaviors
  - In Economics, model of the family and how parents deal with children can be traced to work of Gary Becker encapsulated in *Treatise on the Family*.

- Economic Models of Family Decision-Making
  - Becker's Rotten Kid Theorem
  - Bergstrom's (and others) qualifications to the applicability of Rotten Kid Theorem
  - More recently, work in behavioral economics and differences between parents and children in perception of costs and consequences of risk-taking behaviors (O'Donoghue and Rabin, 2001)
- This Paper
  - Model interactions between parents and children over adolescent risk-taking behaviors
  - Take account of potential inapplicability of Rotten Kid Theorem, but look to other responses parents may take to mitigate adverse consequences of risk-taking by their teenage children
  - We apply the notion of reputation formation in repeated games to the family and derive some testable implications form this framework to behaviors
  - We attempt to test these implications using data on parent-child interactions from the NLSY79 data, examining teenage childbearing decisions of daughters and high school dropout behavior of offspring

**The Game Parents and Teenage Offspring Play:**

***Offspring's Utility Function:***

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***Budget Constraints:***

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**Parents' and Offspring's Decision Problem or Game:**

For each of the parents' children:

*Stage 1*: Child's Problem:

$$\max_{b} U_d(t,b), \tag{4}$$

*Stage 2*: Parent-Planner's Problem:

$$\max_{t_N, t_{N-1}, \ldots, t_0} \sum_k \delta^k W_p[U_p(I_p - t_k, b_k), U_d(t_k, b_k)], \tag{5}$$

***Parent's Preference Orderings:***

*All Parents:* $W_p(t = \cdot, b = 0) > W_p(t = \cdot, b = 1)$ (6)

*Forgiving Parents:* $W_p(t = 1, b = 1) > W_p(t = 0, b = 1)$. (7)

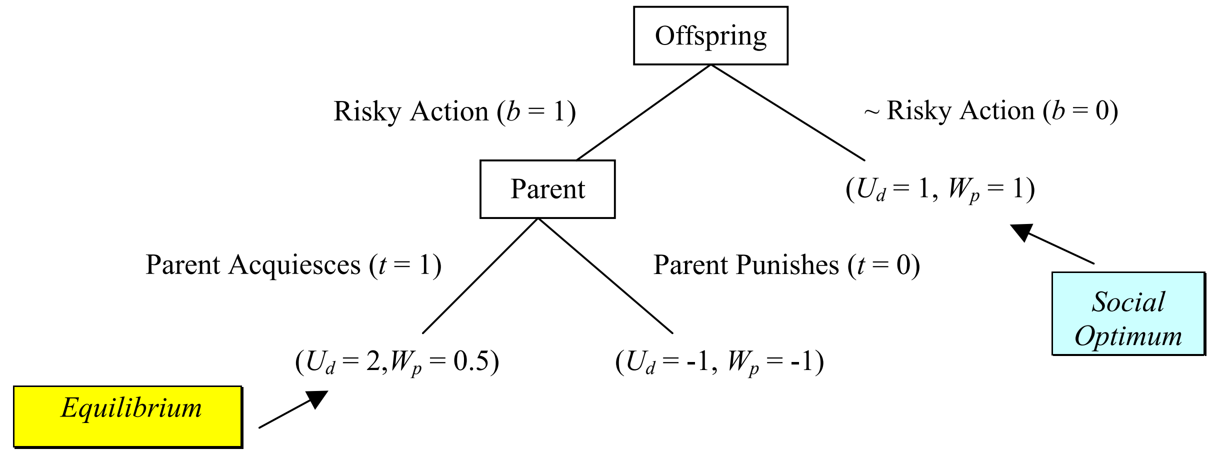
*Unforgiving Parents:* $W_p(t = 1, b = 1) < W_p(t = 0, b = 1)$. (8)

***Offspring's Preference Orderings:***

*Offspring:* $U_d(t = 1; b = 1) > U_d(t = 1; b = 0) > U_d(t = 0; b = 1) > U_d(t = 0; b = 0)$ (9)

where $W_p(t = v_1, b = v_2) \equiv W_p[U_p(I_p - v_1, v_2), U_d(v_1, v_2)]$.

***Case 1: Forgiving Parents***




***Case 2: Unforgiving Parents***

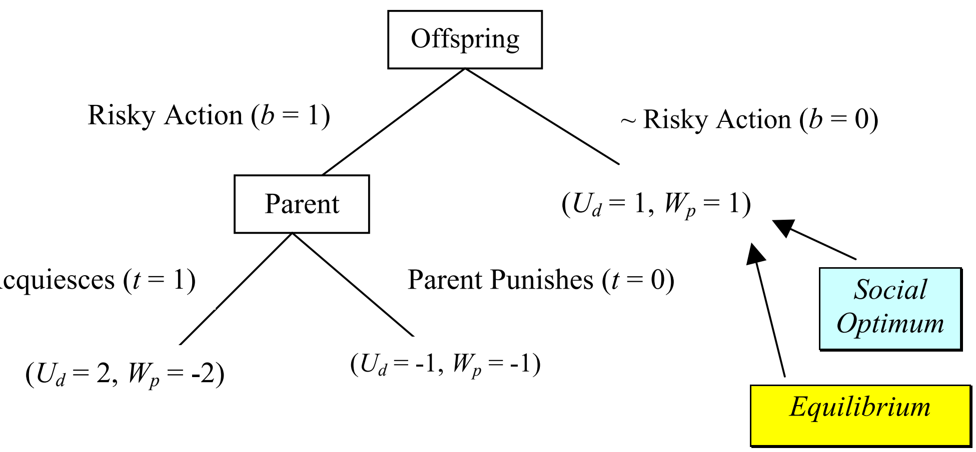



**Figure 1: Decision Tree for Parents' and Offspring's Decisions**

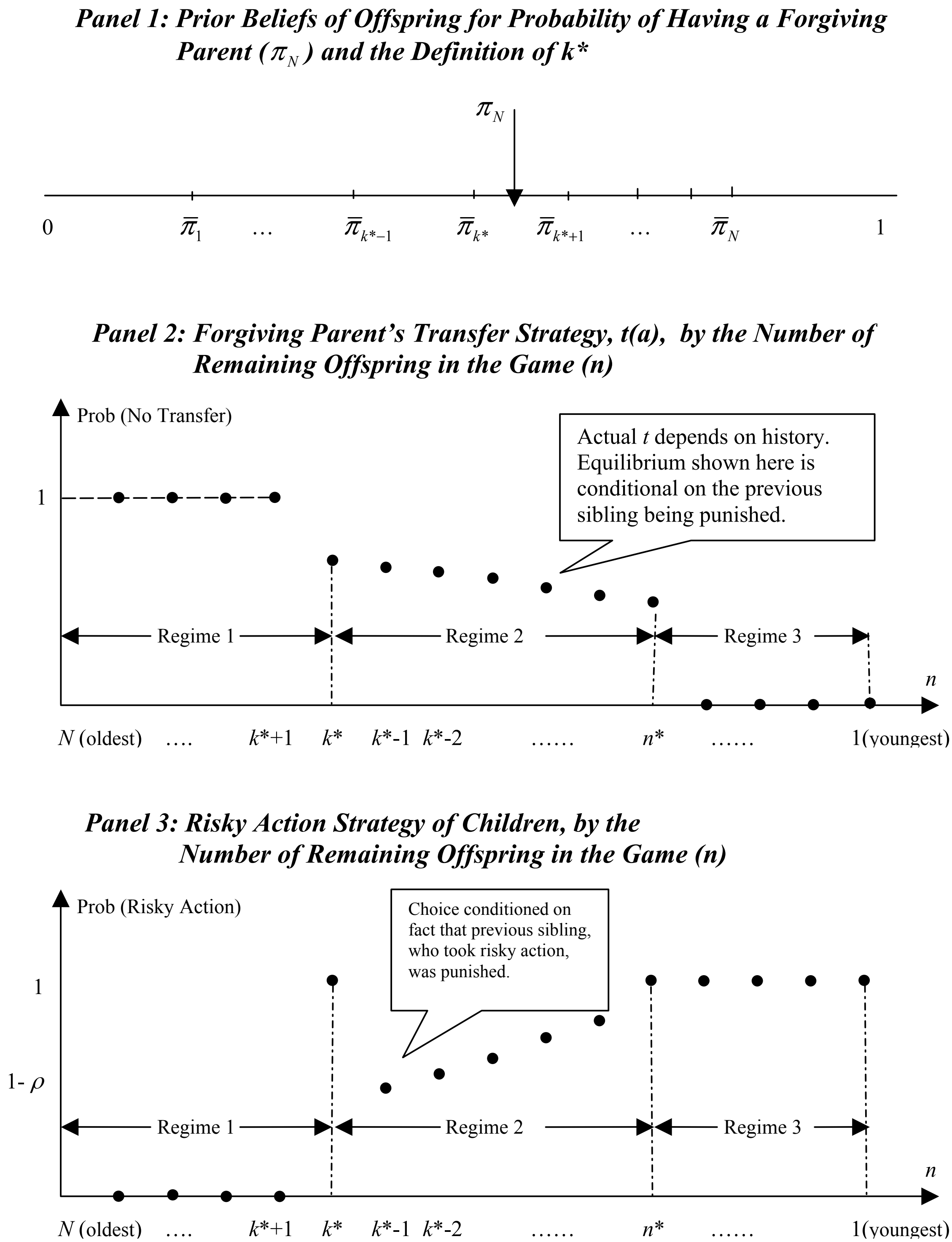



**Figure 2: Features of the Solution to the Offspring and Parent Repeated Game with Reputation Effects**

**Extensions to the Simple Reputation Model of Parent-Teen Interactions**

- ***Parental discounting of the future and their strategic transfer decisions as function of age distribution of their children***

  Role of discounting in above model can important

  We attempt to consider this role by looking to see whether reputation-motivated transfer choices differ by the gap in ages between current child and her next youngest sibling

- ***Spillover of Parental Reputations and Learning by their Children to Other Behaviors***

  To extent that parental preferences are "common" or "similar" across a class of behaviors, parents may try to establish reputation for punishment of a class of behaviors and children my learn about how parents will respond to a particular behavior by observing how they respond to other behaviors

**Offspring's Risky Behavior and Parental Transfer Functions:**

$$G_b\left(n_{pa'_n}, k_p^*, \pi_{np}, I_{pa'_n}, \{E_{a'_n} I_{pi}\}_{i=a'_n+1}^{A_p}, I_{na'_n}, \{E_{a'_n} I_{ni}\}_{i=a'_n+1}^{A_n} \middle| \Omega_{npa'_n}\right) \tag{14}$$

where

$b_{npa'_n}$ denotes risky action indicator for $n^{\text{th}}$ child in $p^{\text{th}}$ family at age $a'_n$

$n_{pa'_n}$, $k_p^*$, $\pi_{np}$, defined above;

$I_{pn\tau}$ parents' income at $\tau$;

$I_{np\tau}$ is the $n^{\text{th}}$ child's income at $\tau$;

$\Omega_{np\tau}$ denotes $n^{\text{th}}$ child's information set, which contains past $b_{jp\tau}$, $t_{jp\tau}$, $I_{p\tau}$ and $I_{j\tau}$ for $j = n+1,\ldots,N$ and $\tau = 0,\ldots,a'_n$, parents rate of time preference, $\delta_p$, and tastes parameters, $\omega_{jp}$, for offspring $j = n,\ldots,N$.

$$G_t\left(b_{np\tau}, n_{p\tau}, k_p^*, \pi_{np}, N_p, I_{p\tau}, \{E_\tau I_{pi}\}_{i=\tau+1}^{A_p}, I_{np\tau}, \{E_\tau I_{npi}\}_{i=\tau+1}^{A_n} \middle| \Omega_{p\tau}\right), \tag{15}$$

where

$t_{np\tau}$ denotes transfer indicator for $p^{\text{th}}$ parents at parents' age $\tau$.

$N_p$ total number of offspring

$\Omega_{p\tau}$ the $p^{\text{th}}$ parents' information set as of $\tau$, which contains $\Omega_{np\tau}$ *plus* taste parameters, $\omega_{jp}$, for the remaining children, $j = 1,\ldots,n$, *and* the parents' taste parameter, $\phi_p$.

We substitute out for lagged risky actions and parental transfer *choices* to derive predictions conditioned on: (a) exogenous incomes ($I_{p\tau}$ and $I_{np\tau}$) and their expectations; (b) tastes of parents and children ($\phi_p$ and $\omega_{np}$), (c) family size ($N_p$); and (d) prior beliefs about parental preferences ($\pi_{Np}$). (See paper for details.)

***Predictions from Repeated Game Model with Reputation:***

$$\frac{\partial\left[\partial G_t\left(b_{npa'_n}, n_{pa'}, k^*_p, \pi_{Np}, \ldots \middle| \omega_{Np}, \ldots, \omega_{1p}, \phi_p, \delta_p\right) \big/ \partial b_{npa'_n}\right]}{\partial n_{pa'_n}} < 0. \tag{20}$$

$$\frac{\partial G_b\left(n_{pa'_n}, k^*_p, \pi_{Np}, N_p, \ldots \middle| \omega_{Np}, \ldots, \omega_{np}\right)}{\partial n_{pa'_n}} < 0. \tag{21}$$

$$\frac{\partial\left[\partial^2 G_t\left(b_{npa'_n}, n_{p\tau}, k^*_p, \pi_{Np}, \ldots \middle| \omega_{Np}, \ldots, \omega_{1p}, \phi_p, \delta_p\right) \big/ \partial b_{npa'_n} \partial n_{p\tau}\right]}{\partial \delta_p} < 0, \tag{22}$$

$$\frac{\partial\left[\partial G_b\left(n_p, k^*_p, \pi_{Np}, N_p, \ldots \middle| \omega_{Np}, \ldots, \omega_{np}\right) \big/ \partial n_{np}\right]}{\partial \delta_p} < 0. \tag{23}$$

**Econometric Specification**

We use the following linearized versions of decision rules for $t_{np\tau}$ and $b_{npa'_n}$ :

$$\begin{aligned} t_{np\tau} &= \alpha_0 + \alpha_1 b_{npa'_n} + \alpha_2 n_{p\tau} + \alpha_3 \tilde{\pi}_{Np} \\ &\quad + \alpha_4 N_p + \alpha_5 AG_{np\tau} + \alpha_6 b_{npa'_n} \cdot n_{p\tau} + \alpha_7 b_{npa'_n} \cdot n_{p\tau} \cdot AG_{np\tau} \\ &\quad + \zeta^a a_n + \zeta^{p\prime} \boldsymbol{x}_p + \sum_{j=1}^{N} \mathrm{z}_j^{n\prime} \boldsymbol{x}_{jp} \\ &\quad + \eta^{\pi} \Delta\pi_{Np} + \eta^{\phi}\phi_p + \sum_{j=1}^{N} \eta_j^{\omega}\omega_{jp} + \eta^{\psi}\psi_p + \sum_{j=1}^{N} \eta_j^{\kappa}\kappa_{jp} \\ &\quad + \sum_{i=0}^{\tau} \eta_i^{\varepsilon}\varepsilon_{pi} + \sum_{j=n+1}^{N} \sum_{i=a'_j}^{\tau} \eta_{ij}^{\nu}\nu_{ipj} \end{aligned} \quad , \tag{26}$$

$$\begin{aligned} b_{npa'_n} &= \beta_0 + \beta_1 n_{pa'_n} + \beta_2 \tilde{\pi}_{Np} + \beta_3 N_p \\ &\quad + \beta_4 AG_{npa'_n} + \beta_5 n_{pa'_n} \cdot AG_{npa'_n} \\ &\quad + \theta^a a_n + \theta^{p\prime} \boldsymbol{x}_p + \sum_{j=1}^{N} \theta_j^{n\prime} \boldsymbol{x}_{jp} \\ &\quad + \gamma^{\pi}\Delta\pi_{Np} + \sum_{j=1}^{N} \gamma_j^{\omega}\omega_{jp} + \gamma^{\psi}\psi_p + \sum_{j=1}^{N} \gamma_j^{\kappa}\kappa_{jp} \\ &\quad + \sum_{i=0}^{a'_n} \gamma_i^{\varepsilon}\varepsilon_{pi} + \sum_{j=n+1}^{N} \sum_{i=a'_j}^{a'_n} \gamma_{ij}^{\nu}\nu_{jpi}, \end{aligned} \tag{27}$$

where

$AG_{npa'_n}$ denotes the age-gap between the $n^{\text{th}}$ child and her next oldest sibling who is under the age of 18,

$\tilde{\pi}_{Np}$ is an error-ridden measure of $\pi_{Np}$

$\Delta\pi_{Np}$ is its measurement error (i.e., $\pi_{Np} = \tilde{\pi}_{Np} + \Delta\pi_{Np}$),

$\alpha$'s, $\theta$'s, $\gamma$'s, $\beta$'s, $\zeta$'s, and $\eta$'s are unknown parameters

**Econometric Estimators Used:**

- OLS, controlling for a range of variables parent- and offspring-specific variables

    Likely to be biased

- "Family-Level Fixed-Effects" Estimators for (27), exploiting data in NLSY79 on "multiple offspring"

    This estimator accounts for endogenous influence of all permanent family-specific unobservables *and* all time-varying variables common to both siblings as of $a'_d$, the age of birth of older offspring in $p^{\text{th}}$ family.

    This estimator does not account for time-varying unobserved characteristics that occur between the time the older and younger offspring in a family make their respective risky action decisions.

- "Offspring-Specific Fixed-Effects" Estimators for (26), exploiting longitudinal data on offspring in NLSY79 data

    This estimator accounts for all of the unobservables "eliminated" by the family fixed-effects estimators *plus* all of the time-varying unobservables that occur as of age of the risky action decisions for *each* offspring in a family. As such, it deals with the potential endogeneity of $b_{npa'_n}$ in (26).

    This is our preferred estimator, but only available for estimating parental transfer equation (26).

**Generalizations of Risky Action and Parental Transfer Decisions and Other Potential Sources of Endogeneity Bias**

- Parents "learn" about their preferences for risky actions as they age.
- Incomes of either parents or offspring are generated by more general processes than the permanent-transitory structure
- If these are true, our fixed-effects estimators may not eliminate all sources of endogeneity bias. We discuss how serious these potential problems are in the paper.

**Data and Samples to be used in Analysis:**

- *Data Source*: NLSY79

  Offspring in our analysis are respondents to this survey

  NLSY79 contains information on

  - fertility of female respondents
  - High school dropout status of all respondents
  - two measures of parental transfers to an offspring (NLSY79 respondent)
  - other family background variables and characteristics of parents and offspring

  NLSY79 contains longitudinal data that we exploit in our econometric analysis

- *Sample Used in Empirical Analyses:*

  We use sample of respondents who have one or more siblings in NLSY79

  This feature of NLSY79 is result of sampling scheme used when original sample was drawn

  1,678 NLSY79 respondents meet this condition, drawn from 772 families

  We refer to this sample as the "multiple-offspring" sample

- *Dependent Variables:*

  $b_{npa'_n}$: 0/1 indicator variable = 1 if offspring undertook a risky action (dropping out of high school or having teen birth) prior to age 18; 0 otherwise.

  $t_{np\tau}$: We use two measures:

  *Financial Transfers:* 0/1 indicator variable = 1 if offspring received at least 50% of income from parents at age $\tau$, $\tau \geq 18$; 0 otherwise.

  *Coresidence Transfers:* 0/1 indicator variable = 1 if offspring coresided with parents at age $\tau$, $\tau \geq 18$; 0 otherwise.

- Definitions of variables in Appendix A; Comparison of full-sample and multiple-offspring sample in Appendix B

**Table 1: Parental Transfers by Offspring's Risky Behaviors, Number of Younger Sibling (Daughters) under Age 18, and per Capita Income in the Family**

**Panel A: By Offspring's High School Dropout Behavior**

| | Co-Residence Transfer | | | | Financial Transfer | | | |
|---|---|---|---|---|---|---|---|---|
| | All Families | | High per Capita Income Families | | All Families | | High per Capita Income Families | |
| | Mean | *N* | Mean | *N* | Mean | *N* | Mean | *N* |
| ***HS Dropout Status:*** | | | | | | | | |
| Not HS dropout | 0.24 | 111,756 | 0.25 | 30,255 | 0.27 | 61,115 | 0.31 | 15,123 |
| High school dropout | 0.24 | 51,765 | 0.25 | 6,191 | 0.21 | 27,952 | 0.27 | 3,077 |
| Average | 0.24 | 163,521 | 0.25 | 36,446 | 0.26 | 89,067 | 0.30 | 18,200 |
| ***(1) High School Dropouts*** | | | | | | | | |
| No. of Offspring younger than 18 | | | | | | | | |
| 0 | 0.20 | 27,525 | 0.21 | 4,132 | 0.20 | 10,724 | 0.26 | 1,782 |
| 1 | 0.34 | 6,357 | 0.39 | 980 | 0.24 | 4,418 | 0.30 | 737 |
| 2 | 0.37 | 3,003 | 0.45 | 253 | 0.25 | 2,453 | 0.36 | 220 |
| 3+ | 0.40 | 2,330 | 0.46 | 73 | 0.25 | 2,078 | 0.26 | 63 |
| Missing | 0.25 | 12,550 | 0.19 | 753 | 0.21 | 8,279 | 0.19 | 275 |
| ***(2) Not High School Dropouts*** | | | | | | | | |
| No. of Offspring younger than 18 | | | | | | | | |
| 0 | 0.20 | 63,646 | 0.22 | 20,770 | 0.25 | 26,586 | 0.28 | 9,108 |
| 1 | 0.40 | 13,065 | 0.47 | 3,910 | 0.33 | 10,112 | 0.40 | 3,228 |
| 2 | 0.44 | 4,584 | 0.54 | 953 | 0.33 | 3,968 | 0.43 | 856 |
| 3+ | 0.49 | 2,669 | 0.62 | 291 | 0.33 | 2,457 | 0.48 | 271 |
| Missing | 0.22 | 27,792 | 0.18 | 4,331 | 0.24 | 17,992 | 0.25 | 1,660 |
| ***(1) Minus (2)*** | | | | | | | | |
| No. of Offspring younger than 18 | | | | | | | | |
| 0 | 0.00 | | -0.01 | | -0.05 | | -0.02 | |
| 1 | -0.07 | | -0.07 | | -0.10 | | -0.10 | |
| 2 | -0.07 | | -0.09 | | -0.08 | | -0.07 | |
| 3+ | -0.09 | | -0.17 | | -0.08 | | -0.22 | |

**Notes**: Sampling weights were used to reproduce the population distribution of means and standard deviations.
*Sample:* Sample of all offspring from the NLSY79 data set.

## Table 1: (Continued)

### Panel B: By Daughter's Teenage Childbearing Behavior

| | Co-Residence Transfer | | | | Financial Transfer | | | |
|---|---|---|---|---|---|---|---|---|
| | All Families | | High per Capita Income Families | | All Families | | High per Capita Income Families | |
| | Mean | *N* | Mean | *N* | Mean | *N* | Mean | *N* |
| ***Teen Birth Status:*** | | | | | | | | |
| No Teen Birth | 0.24 | 62,130 | 0.23 | 17,529 | 0.27 | 31,302 | 0.32 | 8,693 |
| Teen Birth | 0.15 | 9,202 | 0.13 | 854 | 0.12 | 4,601 | 0.16 | 407 |
| Average | 0.26 | 163,521 | 0.25 | 36,446 | 0.26 | 89,067 | 0.30 | 18,200 |
| ***(1) Teen Birth*** | | | | | | | | |
| No. of Daughters younger than 18 | | | | | | | | |
| 0 | 0.12 | 7,010 | 0.12 | 750 | 0.11 | 2,999 | 0.16 | 339 |
| 1 | 0.18 | 1,134 | 0.28 | 61 | 0.10 | 849 | 0.06 | 48 |
| 2 | 0.19 | 400 | 0.16 | 10 | 0.16 | 324 | 0.12 | 6 |
| 3+ | 0.21 | 196 | 0.00 | 2 | 0.15 | 180 | 0.00 | 2 |
| Missing | 0.09 | 462 | 0.00 | 31 | 0.18 | 249 | 0.28 | 12 |
| ***(2) No Teen Birth*** | | | | | | | | |
| No. of Daughters younger than 18 | | | | | | | | |
| 0 | 0.19 | 48,856 | 0.21 | 14,779 | 0.26 | 21,844 | 0.30 | 6,953 |
| 1 | 0.36 | 6,350 | 0.43 | 1,401 | 0.31 | 5,049 | 0.40 | 1,110 |
| 2 | 0.41 | 1,455 | 0.49 | 252 | 0.32 | 1,306 | 0.39 | 226 |
| 3+ | 0.42 | 466 | 0.84 | 27 | 0.35 | 419 | 0.75 | 25 |
| Missing | 0.24 | 5,003 | 0.14 | 1,070 | 0.26 | 2,684 | 0.20 | 379 |
| ***(1) Minus (2)*** | | | | | | | | |
| No. of Daughters younger than 18 | | | | | | | | |
| 0 | -0.07 | | -0.09 | | -0.15 | | -0.14 | |
| 1 | -0.19 | | -0.15 | | -0.20 | | -0.34 | |
| 2 | -0.22 | | -0.33 | | -0.16 | | -0.27 | |
| 3+ | -0.21 | | -0.84 | | -0.19 | | -0.75 | |

**Notes**: Sampling weights were used to reproduce the population distribution of means and standard deviations.
*Sample:* Sample of all daughters in NLSY79 data set.

**Table 2: Offspring's Risky Behaviors by Number of Offspring (Daughters) under Age 18 and per Capita Income in the Family**

**Panel A. All Offspring (Daughters) Sample**

| | High School Dropout | | | | Teen Birth | | | |
|---|---|---|---|---|---|---|---|---|
| | All Families | | High per Capita Income Families | | All Families | | High per Capita Income Families | |
| | Mean | *N* | Mean | N | Mean | N | Mean | *N* |
| No. of Offspring (Daughters) under 18: | | | | | | | | |
| 0 | 0.23 | 3,335 | 0.17 | 1,086 | 0.09 | 2,658 | 0.04 | 847 |
| 1 | 0.23 | 2,544 | 0.16 | 825 | 0.08 | 1,208 | 0.03 | 297 |
| 2 | 0.26 | 1,540 | 0.19 | 338 | 0.12 | 427 | 0.03 | 64 |
| 3+ | 0.36 | 1,398 | 0.16 | 128 | 0.18 | 193 | 0.00 | 10 |
| Missing | 0.27 | 3,869 | 0.17 | 89 | 0.05 | 429 | 0.00 | 12 |
| Total | 0.25 | 12,686 | 0.17 | 2,466 | 0.09 | 4,915 | 0.04 | 1,230 |

Notes: Sample for high school dropout behavior consists of all offspring (respondents) in NLSY79 data set. Sample for teenage childbearing behavior consists of all daughters in NLSY79 data set.

**Panel B. Multiple Offspring (Daughters) Sample**

| | High School Dropout | | | | Teen Birth | | | |
|---|---|---|---|---|---|---|---|---|
| | All Families | | High per Capita Income Families | | All Families | | High per Capita Income Families | |
| | Mean | *N* | Mean | N | Mean | N | Mean | *N* |
| No. of Offspring (Daughters) under 18 | | | | | | | | |
| 0 | 0.21 | 1,400 | 0.15 | 484 | 0.08 | 623 | 0.05 | 184 |
| 1 | 0.19 | 1,501 | 0.12 | 512 | 0.06 | 476 | 0.02 | 129 |
| 2 | 0.22 | 944 | 0.16 | 201 | 0.06 | 209 | 0.01 | 39 |
| 3+ | 0.32 | 849 | 0.14 | 89 | 0.15 | 73 | 0.00 | 6 |
| Missing | 0.27 | 1,169 | 0.17 | 63 | 0.02 | 132 | 0.00 | 8 |
| Total | 0.23 | 5,863 | 0.14 | 1,349 | 0.07 | 1,513 | 0.03 | 366 |

Notes: Sample for high school dropout behavior consists of families with at least 2 children (offspring) in NLSY79 data set. Sample for teenage childbearing behavior consists of families with at least 2 daughters in NLSY79 data set.

## Table 3: Determinants of Parental Transfers

### Panel A: As Function of Offspring's High School Dropout Status

| | Co-Residence Transfer | | | | Financial Transfer | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| No. of Offspring Younger than 18 | 0.0276*** | 0.0278*** | 0.0104*** | 0.0050 | 0.0199*** | 0.0205*** | 0.0073 | 0.0001 |
| | [0.0022] | [0.0022] | [0.0032] | [0.0032] | [0.0036] | [0.0036] | [0.0054] | [0.0055] |
| Missing Younger Offspring Data | -0.0346*** | -0.0353*** | -0.0233*** | -0.0086 | -0.0359*** | -0.0366*** | -0.0224* | -0.0070 |
| | [0.0079] | [0.0079] | [0.0083] | [0.0084] | [0.0125] | [0.0125] | [0.0132] | [0.0133] |
| HS Dropout × No. of Younger Offspring | -0.0472*** | -0.0474*** | -0.0460*** | -0.0374*** | -0.0617*** | -0.0621*** | -0.0601*** | -0.0496*** |
| | [0.0030] | [0.0030] | [0.0032] | [0.0033] | [0.0051] | [0.0052] | [0.0052] | [0.0055] |
| Family's Income per Capita | | 0.1937*** | 0.1717*** | 0.1658*** | | 0.2725*** | 0.2649*** | 0.2946*** |
| | | [0.0478] | [0.0481] | [0.0494] | | [0.0597] | [0.0601] | [0.0614] |
| HS Dropout × Income per Capita | | -0.1900*** | -0.1785*** | -0.1818** | | -0.1627* | -0.1627* | -0.2437** |
| | | [0.0665] | [0.0673] | [0.0734] | | [0.0904] | [0.0914] | [0.0971] |
| Age Gap with Next Oldest Offspring | | | -0.0060*** | -0.0054*** | | | -0.0023* | -0.0019 |
| | | | [0.0008] | [0.0008] | | | [0.0014] | [0.0014] |
| Missing Offspring' Age Gap Data | | | -0.0737*** | -0.0580*** | | | -0.0416*** | -0.0276** |
| | | | [0.0089] | [0.0090] | | | [0.0128] | [0.0130] |
| High School Dropout × Age Gap of Offspring | | | 0.0005 | 0.0010 | | | -0.0001 | 0.0005 |
| | | | [0.0008] | [0.0008] | | | [0.0014] | [0.0014] |
| High per Capita Income Family (> $3,000) | | | | 0.0494 | | | | -0.2163 |
| | | | | [0.1028] | | | | [0.1383] |
| No. of Younger Offspring × High per Cap. Inc. | | | | 0.0671*** | | | | 0.0701*** |
| | | | | [0.0050] | | | | [0.0081] |
| HS Dropout × High per Cap. Income | | | | 0.0345 | | | | 0.6059*** |
| | | | | [0.1410] | | | | [0.2176] |
| HS Dropout × No. of Younger Offspring × High per Cap. Inc. | | | | -0.0430*** | | | | -0.0500*** |
| | | | | [0.0109] | | | | [0.0178] |
| Number of Person-Years | 163,521 | 163,521 | 163,521 | 163,521 | 89,067 | 89,067 | 89,067 | 89,067 |
| Number of Individuals | 12,644 | 12,644 | 12,644 | 12,644 | 12,565 | 12,565 | 12,565 | 12,565 |
| $R^2$ | 0.27 | 0.27 | 0.27 | 0.27 | 0.13 | 0.13 | 0.13 | 0.13 |

Notes: The sample consists of all offspring in NLSY79 data set. Measurement of dependent Variables: Co-Residence Transfer = 1 if the respondent lives with parents, = 0 otherwise. Financial transfer = 1 if parents provide at least half of living expenses, = 0 otherwise.

* p < 0.10; ** p < 0.05; *** p < 0.01

## Table 3: (Continued)

### Panel B: As Function of Daughter's Teenage Childbearing Status

| | Co-Residence Transfer | | | | Financial Transfer | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| # of Younger Daughters (< Age 18) | 0.0246*** | 0.0247*** | 0.0244*** | 0.0195*** | 0.0214*** | 0.0220*** | 0.0306** | 0.0222* |
| | [0.0041] | [0.0041] | [0.0074] | [0.0074] | [0.0072] | [0.0072] | [0.0131] | [0.0132] |
| Missing Younger Daughters Data | -0.0069 | -0.0070 | -0.0100 | 0.0288* | -0.0072 | -0.0068 | -0.0040 | 0.0243 |
| | [0.0155] | [0.0155] | [0.0157] | [0.0161] | [0.0264] | [0.0264] | [0.0269] | [0.0274] |
| Teen Birth × # Younger Daughters | -0.0936*** | -0.0939*** | -0.1037*** | -0.0912*** | -0.0998*** | -0.1001*** | -0.0992*** | -0.0830*** |
| | [0.0080] | [0.0080] | [0.0093] | [0.0094] | [0.0148] | [0.0148] | [0.0153] | [0.0157] |
| Family's Income per Capita | | 0.1003 | 0.0869 | 0.0778 | | 0.2345*** | 0.2400*** | 0.2233*** |
| | | [0.0651] | [0.0653] | [0.0667] | | [0.0797] | [0.0799] | [0.0817] |
| Teen Birth × Income per Capita | | -0.3286*** | -0.2963** | -0.2725** | | -0.2801 | -0.2781 | -0.2868 |
| | | [0.1150] | [0.1170] | [0.1188] | | [0.1884] | [0.1932] | [0.0000] |
| Age Gap with Next Oldest Daughters | | | -0.0049*** | -0.0036*** | | | 0.0041 | 0.0045* |
| | | | [0.0013] | [0.0013] | | | [0.0025] | [0.0025] |
| Missing Sisters' Age Gap Data | | | -0.0291* | -0.0060 | | | 0.0279 | 0.0397 |
| | | | [0.0159] | [0.0160] | | | [0.0256] | [0.0257] |
| Teen Birth × Age Gap of Daughters | | | 0.0036** | 0.0038** | | | -0.0014 | -0.0005 |
| | | | [0.0017] | [0.0017] | | | [0.0032] | [0.0032] |
| High per Capita Income Family (> $3,000) | | | | 0.4520 | | | | 0.5654 |
| | | | | [0.3336] | | | | [0.3901] |
| # Younger Daughters × High per Cap. Inc. | | | | 0.1089*** | | | | 0.0902*** |
| | | | | [0.0102] | | | | [0.0167] |
| Teen Birth × High per Cap. Income | | | | | | | | |
| Teen Birth × # Younger Daughters × High per Cap. Inc. | | | | -0.0864* | | | | -0.1810** |
| | | | | [0.0494] | | | | [0.0796] |
| Number of Person-Years | 71,332 | 71,332 | 71,332 | 71,332 | 35,903 | 35,903 | 35,903 | 35,903 |
| Number of Individuals | 4,908 | 4,908 | 4,908 | 4,908 | 4,878 | 4,878 | 4,878 | 4,878 |
| $R^2$ | 0.28 | 0.28 | 0.28 | 0.28 | 0.13 | 0.13 | 0.13 | 0.14 |

Notes: The sample consists of all daughters in NLSY79 data set. Measurement of dependent Variables: Co-Residence Transfer = 1 if the respondent lives with parents, = 0 otherwise. Financial transfer = 1 if parents provide at least half of living expenses, = 0 otherwise.
* p < 0.10; ** p < 0.05; *** p < 0.01

## Table 4: Determinants of Risky Behaviors of Offspring (Daughters)

### Panel A: Offspring's High School Dropout Decision

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| No. of Offspring Younger than 18 | -0.0267*** | -0.0260*** | -0.0313*** | -0.0292** |
| | (0.0100) | (0.0100) | (0.0114) | (0.0115) |
| Missing Younger Offspring Data | 0.0331 | 0.0310 | 0.0306 | 0.0280 |
| | (0.0504) | (0.0505) | (0.0506) | (0.0507) |
| Family's Income per Capita | | 0.0134 | 0.0137 | 0.0054 |
| | | (0.0110) | (0.0110) | (0.0140) |
| Missing per Capita Income | | -0.0068 | -0.0075 | -0.0097 |
| | | (0.0713) | (0.0714) | (0.0714) |
| Age Gap with Next Oldest Offspring | | | -0.0040 | -0.0045 |
| | | | (0.0045) | (0.0046) |
| Missing Offspring' Age Gap Data | | | -0.0326 | -0.0412 |
| | | | (0.0303) | (0.0309) |
| High per Capita Income (> $3,000) | | | | 0.0807 |
| | | | | (0.0688) |
| No. of Younger Offspring × High per Cap. Inc. | | | | -0.0281 |
| | | | | (0.0205) |
| Number of Individuals | 5,863 | 5,863 | 5,863 | 5,863 |
| Number of Families | 2,445 | 2,445 | 2,445 | 2,445 |
| $R^2$ | 0.06 | 0.06 | 0.06 | 0.06 |

Notes: The sample consists of offspring in families with 2-4 offspring in NLSY79 data set.

### Panel B: Daughter's Teenage Childbearing Decision

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| No. of Daughters Younger Than 18 | -0.0246 | -0.0267 | -0.0273 | -0.0255 |
| | (0.0220) | (0.0221) | (0.0276) | (0.0277) |
| Missing Younger Daughters Data | -0.0489 | -0.0520 | -0.0603 | -0.0600 |
| | (0.0817) | (0.0818) | (0.0819) | (0.0820) |
| Family's Income per Capita | | -0.0229 | -0.0236 | -0.0204 |
| | | (0.0181) | (0.0181) | (0.0219) |
| Missing per Capita Income | | -0.0896 | -0.0971 | -0.0936 |
| | | (0.1258) | (0.1258) | (0.1261) |
| Age Gap with Next Oldest Sister | | | -0.0110 | -0.0113* |
| | | | (0.0068) | (0.0068) |
| Missing Sisters' Age Gap Data | | | -0.0276 | -0.0342 |
| | | | (0.0487) | (0.0495) |
| High per Capita Income (> $3,000) | | | | -0.0151 |
| No. of Younger Daughters × High per Cap. Inc. | | | | -0.0278 |
| | | | | (0.0379) |
| Number of Individuals | 1,513 | 1,513 | 1,513 | 1,513 |
| Number of Families | 692 | 692 | 692 | 692 |
| $R^2$ | 0.02 | 0.03 | 0.03 | 0.03 |

Notes: The sample includes daughters in families with 2-4 daughters in NLSY79 data set